Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

TABLE OF CONTENTS

ACRONYMS

CSO	Central Statistics Office
cSO	Combined sewer overflow
CiS	Complete Information System
DEHLG	Department of the Environment, Heritage and Local Government
DCMNR	Department of Communications, Marine and Natural Resources
LA	Local authority
LG	Local government
OD	Ordnance datum
SI	Statutory Instrument
EC	European Community
EU	European Union
EPA	Environmental Protection Agency
ESB	Electricity Supply Board
BOD	Biological oxygen demand
COD	Chemical oxygen demand
WWTP	Waste Water treatment plant
NH_3	Ammonia
SS	Suspended solids
P	Phosphorus
ND	No data
pe	Population equivalent
M	Million
N/A	Not applicable
d/s	Downstream
u/s	Upstream

SCIENTIFIC TERMS

m^3/s	Cubic metres per second
l/s	Litres per second
mg/l	Milligrams per litre
km	Kilometres
Ml/d	Megalitres per day
kg/d	Kilograms per day
m	Metres
dia.	Diameter
mm	Millimetres
tds	Tonnes dry solids
Tds/d	Tonnes dry solids per day
ha	Hectares
% ds	Percent dry solids
MLSS	Mixed Liquor Suspended Solids

DEFINITIONS

Summary definitions for Confidence Grades, Asset Condition Grades and Core Area Sewers are given below. For comprehensive definitions of the terms used, refer to Part 2A of Volume 2.

Asset Condition Grades*
The structural or functional condition of waste water assets is usually identified by the numbers 1 to 5, where 1 represents 'as new' condition and 5 represents a failed or substantially derelict asset. For the purpose of this study, only the upper three grades, as defined below, are used

For sewers and sewage rising mains the definitions are:

≤ 3 **Normal wear and tear**; no failures or structural defects and mains designed to current standards (Grade 1) through to significant defects evident in the fabric of sewers or deterioration beginning to be reflected in the levels of service and/or operating costs (Grade 3). Replacement/renovation of mains required within 10 years, review of condition of sewers in the medium term.

4 **Serious structural deterior
atio**n in sewers (5-10% deformation, displacement, cracking); rising mains nearing the end of their useful life with frequent bursts and reduction in level of service. Asset renovation/replacement required in medium term.

5 **Assets collapsed or substantially derelict**, frequent rising main bursts & no residual life expectancy. The asset will require replacement within short term.

For 'above ground' civil, mechanical & electrical works, the definitions are:

≤ 3 **Normal wear and tear**; sound modern structure and plant, which is operable and maintained (Grade 1) through to structure and plant which is functionally sound or adequate but is significantly affected by deterioration with some reduced efficiency and minor failures (Grade 3) – review of condition required in the medium term.

4 **Structural deterioration having a significant effect on performance** due to leakage or other problems; plant functions but requires significant maintenance to remain operational. Major overhaul/replacement required in medium term.

5 **Serious structural problems, effective life of plant exceeded;** structural problems having a detrimental effect on the performance, unreliable and incurring excessive maintenance costs compared to replacement. The asset will require major overhaul/replacement in short term.

* With acknowledgements to The Office of Water Services, Strategic Business Plan Manual, UK.

Data Confidence Grades
All data was assigned a 'Source Code' or Confidence Grade in the range 1 to 5, to reflect the confidence, which it was considered an external party could attach to the data without further checking. The grades are directly related to the sources of available information. The definitions used in conjunction with the data collection questionnaires are:

1 **High degree of confidence**; based on comprehensive current records

2 **Relatively high degree of confidence**; records are generally current and comprehensive with only limited shortcomings.

3 **Reasonable confidence**; records, although not wholly complete or up to date, were confirmed by local staff as correct and/or have passed selective checks.

4 **Low level of confidence**; basic records are poor and local knowledge is sketchy and uncorroborated.

5 **Very low level of confidence**; no formal records or detailed knowledge of the assets or data and no corroborative checks possible.

Core Area Sewers
The core area network comprises the critical sewers, which it would be economic to maintain and repair on a pre-emptive basis, plus any interconnecting sewers. Critical sewer are defined as those for which the cost consequences of collapse or failure would outweigh the cost of investigation and pre-emptive renovation.

The core area sewers generally comprise the trunk sewer network making up an estimated 25% of the total sewer length in a catchment.

1. GENERAL APPROACH

1.1 NEEDS AND OBJECTIVES

To ensure effective management of capital resources for development of west water infrastructure, the DEHLG initiated the National Urban Waste Water Study (NUWWS), with primary objectives as summarised below.

1) Prepare an inventory of the waste water infrastructure, including an assessment of its condition and performance, for each catchment with a population equivalent of 2,000 or more, outside the Greater Dublin Area. Also identify the operational control and staffing structure for each catchment.
2) Outline the sewerage system deficiencies, including records deficiencies and set out proposals for such survey work and network analysis as may be considered necessary to develop future upgrading proposals.
3) Assess the ability of the treatment facilities, where available, to comply with the relevant legislation and national or local standards, including the assimilative capacity of the receiving waters, based on realistic estimates of flow and load. Based on these assessments, prepare outline recommendations for any necessary upgrading works.
4) Develop guidelines to facilitate implementation of national programme of waste water infrastructure rehabilitation on a planned basis, including criteria and indicators for prioritising future capital investment and monitoring the performance of schemes.

1.2 COMPARABILITY OF INFORMATION

To ensure national consistency and comparability of information, in terms of both the data collected and the assessments carried out, a series of standard questionnaires and assessment methodologies were prepared as part of this study. The data collection and assessment processes are briefly described below and the individual methodologies given in the following Parts A2 to A7.

1.3 DATA CAPTURE

Catchment data covering both the sewerage networks and WWTPs, was obtained from the LAs by means of a standard questionnaire illustrated in Part A2 of this volume. The questionnaire was made up of five parts, as listed below, and included a requirement for geographic data on the catchment and WWTP.

Sewerage Network Questionnaire (12 pages)

Treatment Plant Questionnaire in four parts
Part 1 - Loadings & Flow (6 pages)
Part 2 - Treatment Process (11 pages)
Part 3 - Receiving Waters A (3 pages)
Part 4 - Receiving Waters B (2 pages)

No field checking of sewerage records was involved, however all significant treatment plant sites were visited and the treatment process, plant layout and sample dimensions were checked. Small works such as buried septic tanks were not generally inspected.

The questionnaire returns were subsequently used to populate the national database and geographic information system (GIS) which is described in Part B.

Prior to assessing catchment performance etc., the questionnaire returns were reviewed for completeness and reliability of information. Probable values for catchment population, length of sewer network etc., were determined through a series of sub-studies and missing or unreliable data was replaced with standard estimates.

1.4 SEWERAGE NETWORK ASSESSMENT

The hydraulic performance and structural condition of the network was assessed from historic performance data, the results of sewers surveys and where the relevant information was available, from hydraulic analysis. Where practical to do so, the capacity of the network to meet current and future development needs was also quantified. Where the required network inventory data was not available, indicative sewer lengths, diameters and condition data was based on the results of a sub-study, which is described in Part A3.

Based on questionnaire returns, data deficiencies (sewer records) were noted and the survey work necessary to provide information for effective management of the network and the design of any necessary upgrading works was identified. The method of assessing survey requirements is described in Part A7 and the cost estimates for survey and network assessment purposes are described in Part D of this volume.

1.5 TREATMENT PLANT & RECEIVING WATERS ASSESSMENT

The flow and load from the sewerage catchment to treatment (where applicable), was assessed for the base year 2002 and the target year 2022 using the standard methodology described in Part A4.

The receiving waters assimilative capacity was determined on the basis of available sampling records, river water quality objectives and the relevant legislation and national or local standards.

The quality of treated effluent in terms of the concentration of key parameters was identified and the ability of the receiving water to assimilate the effluent assessed as described in Part A5. The capacity of the treatment plant in relation to the flows and loads in the base and target years was assessed on a standardised basis, as described in Part A6.

Actual or potential shortcomings in the level of treatment relative to the requirements of the relevant EU Directives were identified. Sludge volumes were estimated and details of current and projected disposal facilities were derived from the questionnaires and/or sludge management plans. Based on the above information, the upgrading of treatment facilities was outlined for each catchment.

1.6 GUIDELINES

Guidelines to facilitate implementation of national programme of waste water infrastructure rehabilitation, including a standardised approach to prioritising future capital investment and monitoring the performance of schemes form Part C of this volume.

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL

DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

2. DATA COLLECTION

Pettit Project Design & Management

BARRY & PARTNERS consulting engineers

White Young Green Ireland

Babtie

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Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

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PART 2 - TREATMENT PROCESS

PART 3 - RECEIVING WATERS (A)

PART 4 - RECEIVING WATERS (B)

PART 1 - LOADINGS & FLOW

1.0.0 GENERAL INFORMATION

County __________ Sanitary Authority __________

Catchment Name: ____________________

Catchment Number: ____________________

Catchment Code: ____________________

1.1.0 WASTE WATER TREATMENT PLANT CONTACT DETAILS

1.1.1 Treatment Plant ____________________

Postal Address ____________________

____

____

Telephone ____________

Facsimile ____________

E-Mail ____________

1.1.2 Primary Contact ____________________

1.1.3 Position Title ____________________

1.1.4 Directions to Plant ____________________

____

____

1.1.5 Plant Ordnance Survey Grid Reference [ ]

1.2.0 CURRENT WASTE WATER LOADING

Insert "M" for Measured or "E" for Estimated, in the box provided to the right of each parameter

		PE	DWF (m^3/d)	BOD (kg/d)	COD (kg/d)	P (kg/d)	NH3 (kg/d)	SS (kg/d)
1.2.1	**Total**							

note: the above total figure should be broken down hereunder into the constituent parts wherever possible

	Sector	DWF	BOD	Basis of Estimated Values
1.2.2	Domestic	m^3/day	kg/day	
1.2.3	Industrial	m^3/day	kg/day	
1.2.4	Commercial	m^3/day	kg/day	
1.2.5	Institutional	m^3/day	kg/day	
1.2.6	Tourism	m^3/day	kg/day	
1.2.7	Imported Liquours	m^3/week	kg/week	
1.2.8	Imported Sludges	m^3/week	kg ds/week	

1.3.0 FUTURE WASTE WATER LOADING for Year 2022

		PE	DWF (m^3/d)	BOD (kg/d)	COD (kg/d)	P (kg/d)	NH3 (kg/d)	SS (kg/d)
1.3.1	**Total**							

note: the above total figure should be broken down hereunder into the constituent parts wherever possible

	Sector	DWF	BOD	Basis of Estimated Values
1.3.2	Domestic	m^3/day	kg/day	
1.3.3	Industrial	m^3/day	kg/day	
1.3.4	Commercial	m^3/day	kg/day	
1.3.5	Institutional	m^3/day	kg/day	
1.3.6	Tourism	m^3/day	kg/day	
1.3.7	Imported Liquours	m^3/week	kg/week	
1.3.8	Imported Sludges	m^3/week	kg ds/week	

1.4.0 SPECIAL CHARACTERISTICS OF INFLUENT

1.4.1	Fats,Oils & Greases	☐ Yes	☐ No
1.4.2	Acids	☐ Yes	☐ No
1.4.3	Alkalis	☐ Yes	☐ No
1.4.4	Nitrification Inhibitors	☐ Yes	☐ No
1.4.5	Evidence of Infiltration	☐ Yes	☐ No

1.5.0 Surface or Storm Water Loading

1.5.1 What is the Peak Flow to Works ________ l/s ☐ Measured ☐ Estimated

1.6.0 Non Domestic Discharges

1.6.1 List the principal licenced (IPC & Section 16) trade discharges to the Scheme/Treatment Plant

Industry Type	Name	To WWTP or Sewer	DWF (m^3/d)	BOD (kg/d)	P (kg/d)	NH3 (kg/d)	SS (kg/d)

1.6.2 Has a polluter Pays Principle Report been prepared for the Scheme ☐ Yes ☐ No

1.6.3 If yes, is the listing of contributing companies and activities consistent with the above list ☐ Yes ☐ No

1.6.4 If not consistent, clarify and amend the above table if necessary

1.6.5 Are any of the Industrial contributors subject to large Seasonal Variations? ☐ Yes ☐ No

1.6.6 Quantify the above in terms of the listed constituents

Time of Year		PE	DWF (m^3/d)	BOD (kg/d)	P (kg/d)	NH_3 (kg/d)	SS (kg/d)
	Max Loadings						
	Min Loadings						

1.7.0 Sludge

1.7.1 Are sludges delivered to the WWTP? ☐ Yes ☐ No

1.7.2 If yes, please quantify these imported sludges under the following headings: **Source Code**

1.7.3 Volume per week ☐ m^3 ☐

1.7.4 % D.S. ☐ % ☐

1.7.5 Indigenous Sludges

Please quantify the sludges generated on-site under the following headings;

1.7.6 Volume per week ☐ m^3 (Total of primary, humus,secondary, etc.) ☐

1.7.7 % D.S. ☐ % ☐

1.8.0 Effluent Discharge Quality

Detail hereunder the treated effluent quality design standards and the actual effluent quality
Insert "M" for Measured or "E" for Estimated, in the box provided to the right of each parameter

		BOD (mg/l)		SS (mg/l)		Total N (mg/l)		NH_3 (mg/l)		P (mg/l)		Sample Type*
1.8.1	Required Standard											
1.8.2	Current Quality											

* Grab sample or Composite sample

Data Supplied by: ______________________ Local Authority Engineer **Date** ____________

Compiled by : ______________________ JV Team Member **Date** ____________

Verified by : ______________________ JV Team Leader **Date** ____________

PART 2 - TREATMENT PROCESS

2.0.0

NOT USED

2.1.0

2.1.1

2.1.2.

2.1.3

2.1.4

2.1.5

2.2.0	**GENERAL SITE INFORMATION**	
2.2.1	Area of Site	______ ha
2.2.2	Is land available for expansion on-site	☐ Yes ☐ No
2.2.3	Site Layout Plan Provided	☐ Yes ☐ No
2.2.4	Site Layout Plan prepared on Site	☐ Yes ☐ No
2.2.5	Site Layout Plan checked on Site	☐ Yes ☐ No
2.2.6	Process Flow Diagram provided	☐ Yes ☐ No
2.2.7	Process Flow Diagram prepared on Site	☐ Yes ☐ No
2.2.8	Process Flow Diagram checked on site	☐ Yes ☐ No
2.2.9	Year Plant Commissioned	☐
2.2.10	Last major refurbishment Year	☐
2.2.11	Plant Drawings Available	As Built ☐ Tender ☐ Not Available ☐

2.3.0 PRELIMINARY TREATMENT

				Structural Condition (S.C.)	Performance (P)
2.3.1 Preliminary Treatment		☐ Yes	☐ No		
2.3.1.1 *Screening*		☐ Yes	☐ No		
Type :	Manual	☐			
	Mechanical	☐			
	Model	______		☐	☐
	Aperture		☐ mm		
Screening Treatment		☐ Yes	☐ No	☐	☐
Screening Disposal - Define		______			
2.3.1.2 *Disintegration*		☐ Yes	☐ No		
Type :	Comminutor	☐		☐	☐
	Macerator	☐		☐	☐
	Muncher	☐		☐	☐
	Other	☐		☐	☐
	Details ______				
2.3.1.3 *Grit Removal*		☐ Yes	☐ No		
Type :	Vortex Grit Separator		☐	☐	☐
	Aerated Grit Trap		☐	☐	☐
	Grit Channel		☐	☐	☐
	Other		☐	☐	☐
	Details ______				
Grit Treatment		☐ Yes	☐ No		
Grit Disposal - Define		______			

2.3.1.4 *Storm Tanks* ☐ Yes ☐ No Source Code ☐

No. of Tanks ☐ ☐ ☐

Volume of Tanks ☐ m^3

Cleaning Mechanism ☐ Yes ☐ No **S.C.** **P**

		S.C.	P
Rotating Half Bridge	☐	☐	☐
Travelling Bridge	☐	☐	☐
Tipping Buckets	☐	☐	☐
Other	☐	☐	☐

Details ____________________

Return Pumps ☐ Yes ☐ No

No. of pumps ☐ ☐ ☐

Capacity of pumps ☐ l/s

2.3.1.5 *In Line Flow Balancing* ☐ Yes ☐ No

Description ____

____

Operational Problems ____

____

2.3.1.6 *Flow Measurement* ☐ Yes ☐ No

Type :	Inlet	Outlet	S.C.	P
Weir	☐	☐	☐	☐
Flume	☐	☐	☐	☐
Ultrasonic	☐	☐	☐	☐
Electromagnetic	☐	☐	☐	☐
Other	☐	☐	☐	☐

2.3.1.7	*Sampling Point at Inlet*	☐ Yes	☐ No	☐	☐
	Manual	☐ Yes	☐ No		
	Automated	☐ Yes	☐ No		
	Are regular samples taken	☐ Yes	☐ No		
2.3.1.8	*pH Correction*	☐ Yes	☐ No	☐	☐
	Method	________			
2.3.1.9	*Oil, Fat & Grease (OFG) Removal*	☐ Yes	☐ No	☐	☐
	Reason for installation	________			
	Type of Removal Process				
	Physical	☐ Yes	☐ No		
	Type : Skimming Tanks	☐ Yes	☐ No	☐	☐
	Circular Grease Separator	☐ Yes	☐ No	☐	☐
	Circular Grit / Grease Separator	☐ Yes	☐ No	☐	☐
	Aerated Skimming Tanks	☐ Yes	☐ No	☐	☐
	Rectangular Grit/Grease Separator	☐ Yes	☐ No	☐	☐
	Dissolved Air Flotation	☐ Yes	☐ No	☐	☐
	Vacuum Flotation System	☐ Yes	☐ No	☐	☐
	Biological	☐ Yes	☐ No	☐	☐
2.3.1.10	Chemical dosing for enhanced settlement / P precipitation	☐ Yes	☐ No	☐	☐
	Reason for installation	________			
2.3.1.11	Description of Chemicals dosed	________			
		________			

2.4.0 PRIMARY TREATMENT

Source Code ☐

				S.C.	P
2.4.1 Primary Treatment	☐ Yes	☐ No			
Peak Flow	☐ l/s	☐ Measured	☐ Estimate		
		Vol			
Type: Circular Radial Flow	☐	☐ m^3		☐	☐
Rectangular Horz Flow	☐	☐ m^3		☐	☐
Imhoff Tank	☐	☐ m^3		☐	☐
Septic Tank	☐	☐ m^3		☐	☐
Dissolved Air Flotation (DAF)	☐	☐ m^3		☐	☐
Other	☐	☐ m^3		☐	☐
No. of Tanks		☐ Nr.			
Total Area of Tanks		☐ m^2			

2.5.0 SECONDARY TREATMENT

Source Code ☐

2.5.1 Secondary Treatment	☐ Yes	☐ No			
Peak Flow	☐ l/s	☐ Measured	☐ Estimate		

Process purpose (Tick Relevant Box('s))

Carbonaceous removal only	☐
Nitrification (NH_3 ---> NO_3 + NO_2)	☐
Denitrification (NO_3 + NO_2 --> N_2 gas)	☐
Phosphorus removal	☐

Single Stage	☐ Yes	☐ No		
Two Stage	☐ Yes	☐ No		
Natural Treatment (e.g. Reed Beds)	☐	Stage ☐ 1 or 2	☐	☐

Description ____________________

Stabilisation Process (e.g. Lagoons)	☐	Stage ☐ 1 or 2	☐	☐

Description ____________________

____

____

				S.C.	P
Aerobic Process	☐				
Suspended Growth	☐	Stage ☐ 1 or 2		☐	☐
Conventional Activated Sludge		☐		☐	☐
Extended Aeration		☐		☐	☐
Sequence Batch Reactor		☐		☐	☐
Oxidation Ditch		☐		☐	☐
Membrane Bio Reactor		☐		☐	☐
Other		☐		☐	☐
Description	______				
No. of Reactors		☐			
Total Vol. of Reactors		☐ m^3			
Reactor Shape	______				
Type of Aeration	______				
Attached Growth	☐	Stage ☐ 1 or 2			
Trickling Filter		☐		☐	☐
Percolation Filter		☐		☐	☐
RBC		☐		☐	☐
BAF		☐		☐	☐
Other		☐		☐	☐
Details	______				
No. of Tanks		☐			
Volume of Tanks		☐ m^3			
Plan Area		☐ m^2			
Tank Shape	______				
Type of Media	______				

				S.C.	P.
Anaerobic Process	☐				
Suspended Growth	☐	Stage ☐ 1 or 2			
Anaerobic Digestion		☐		☐	☐
Anaerobic Contact		☐		☐	☐
Attached Growth	☐	Stage ☐ 1 or 2			
Anaerobic Filter		☐		☐	☐
Expanded bed		☐		☐	☐
Sedimentation Stage	☐ Yes	☐ No		☐	☐

Description ______________________________

No. of Tanks	☐				
Plan Area	☐ m^2				
Enhanced solids removal:	☐ Yes	☐ No		☐	☐
Banks(stone) filter, Mesh, Brush, Other?	☐			☐	☐

2.6.0 TERTIARY TREATMENT Source Code ☐

2.6.1 Tertiary Treatment	☐ Yes	☐ No			
2.6.1.1 *Filtration*	☐ Yes	☐ No			
Micro Straining	☐			☐	☐
Sand Filtration	☐	☐ Area		☐	☐
Grass Plot	☐	☐ Area		☐	☐
2.6.1.2 *Disinfection*	☐ Yes	☐ No			
UV	☐	☐ watts/m		☐	☐
Chlorine	☐	☐ g/hr		☐	☐
Ozone	☐			☐	☐
2.6.1.3 *Other*	☐ Yes	☐ No			

Description ______________________________

2.7.0	**SLUDGE TREATMENT**	Source Code	☐				
2.7.1	Sludge Treatment		☐ Yes	☐ No			
2.7.1.1	*Thickening*		☐ Yes	☐ No		**S.C.**	**P**
	Picket Fence		☐			☐	☐
	Belt Thickener		☐			☐	☐
	Capacity			☐ kg ds/hr			
2.7.1.2	*Dewatering*		☐ Yes	☐ No			
	Belt		☐			☐	☐
	Centrifuge		☐			☐	☐
	Plate		☐			☐	☐
	Capacity			☐ kg ds/hr			
	Dry Solids achievable			☐ %			
2.7.1.3	*Advanced Treatment*		☐ Yes	☐ No			
	Drying		☐			☐	☐
	Composting		☐			☐	☐
	Vermiculture		☐			☐	☐
	Stabilisation		☐			☐	☐
	Drying Beds		☐			☐	☐
	Digestion		☐			☐	☐
	Storage		☐ Yes	☐ No		☐	☐
		Capacity	☐				
	Reception		☐ Yes	☐ No		☐	☐
		Capacity	☐				

2.7.1.4 Has a Sludge Management Plan been prepared for the area ☐ Yes ☐ No

2.7.1.5 Does it have an Impact on this Plant ☐ Yes ☐ No

Details ____________________

2.7.1.6 *Sludge Disposal*

Where is sludge currently being disposed to? ____________

Where will sludge be disposed to in 5 years ____________

Where will sludge be disposed to in 20 years ____________

2.8.0 ANCILLARY TREATMENTS

2.8.1	Ancillary Treatment	☐ Yes	☐ No	**S.C.**	**P**
2.8.1.1	Phosphorus Removal	☐		☐	☐
2.8.1.2	Other	☐		☐	☐

Details ____________________

____

____

2.9.0 PLANT ANCILLARIES

2.9.1 Plant Ancillaries

2.9.1.1	Odour Control	☐ Yes	☐ No		
2.9.1.2	Noise Attenuation	☐ Yes	☐ No		
2.9.1.3	Process Control & Monitoring	☐ Yes	☐ No		
	SCADA System	☐ Yes	☐ No	☐	☐

Where is Control/Monitoring carried out ____________

2.9.1.4 Electricity Standby ☐ Yes ☐ No

2.9.1.5 Health & Safety - comments ____________

____

____

2.9.2 Minor Infrastructure

2.9.2.1 Buildings (excluding non man entry plant covers)

Administration/ Control Buildings	☐ Yes	☐ No	☐	☐
Sludge Building	☐ Yes	☐ No	☐	☐
Air Blower Building	☐ Yes	☐ No	☐	☐
Inlet Works Building	☐ Yes	☐ No	☐	☐
Pump House	☐ Yes	☐ No	☐	☐
Other	☐ Yes	☐ No	☐	☐
____________________			☐	☐

2.9.2.2 Surfaced Roads	☐ Yes	☐ No	☐	☐
2.9.2.3 Fencing around Site	☐ Yes	☐ No	☐	☐

2.9.2.4 General Site Area (maintained/drained, etc.)

Description____

2.10 OPERATION / MAINTENANCE

2.10.1 Describe the Staffing Structure in place to operate and maintain all aspects of the Treatment Plant to include Engineers, Technicians, Caretakers & others and the input per year of the various disciplines.

2.10.2 Operational Problems

____
____
____
____
____
____
____
____
____
____

2.11 Capital Schemes/ Potential Solution

____
____
____
____
____
____
____
____
____
____

Data Supplied by: ____________________ **Date**__________
Local Authority Engineer
or Caretaker

Compiled by : ____________________ **Date**__________
JV Team Member

Verified by : ____________________ **Date**__________
JV Team Leader

PART 3 - RECEIVING WATERS (A)

3.0.1 County____________________ Sanitary Authority___________________

Scheme/catchment name ____

3.1.0 RECEIVING WATERS

3.1.1 Name of Receiving Waters ____________________________________

3.1.2 Number of discharges Combined__, Foul__, Treated Eff__

3.1.3 O.S. Grid Ref of end of each outfall ____________________________________

____

3.1.4 Type & Length of Outfall/Discharge (long/short/etc) _____m _________________

3.2.0 TYPE OF RECEIVING WATERS

3.2.1 Inland Surface Water System ☐ Yes ☐ No

- River Discharging to Lake ☐
- Lake ☐
- River Discharging to Coastal Waters ☐
- Distance to coastal water (+/-5km) ___km
- Other: Desc. ____________________________

3.2.2 Coastal & Estuarine Waters ☐ Yes ☐ No

- Open Coastline ☐
- Bay ☐
- Estuary ☐
- Other: Desc. ____________________________

3.2.3 Groundwater System ☐ Yes ☐ No

- Sinking River ☐
- Turlough ☐
- Land Application ☐
- Other: Desc. ____________________________

3.3.0 RESOURCE & AMENITY VALUE OF RECEIVING WATER

Distance either side of outfall

3.3.1 Drinking Water

* Abstraction downstream of discharge ☐ Yes ☐ No ______ m
* Proximity to Vulnerable Aquifer ☐ Yes ☐ No ______ m
* Details ______________________

3.3.2 Bathing Areas Local to Waste Water Outfall

* Blue Flag Beach ☐ Yes ☐ No ______ m

  Details ______________________

* Designated Bathing Area ☐ Yes ☐ No ______ m

  Details ______________________

* Traditional Bathing Area ☐ Yes ☐ No ______ m

  Details ______________________

* Other Comments ______________________

3.3.3 Other Recreational Activities Desc. ____________ ______ m

3.3.4 Fishing (Game/Course) Type : ____________ ______ m

3.3.5 Mariculture (Fish Farming) Type: ____________ ______ m

3.4.0 Quality of Receiving Waters

3.4.1 Local Authority Monitoring

* Monitoring Data Available ☐ Yes ☐ No ______ m
* Year to which data relates ______________________
* Other Comments ______________________

3.4.2 General Pollution

* Recorded Incidents at WWTP Outfall ☐ Yes ☐ No ______ m
* Recorded Incidents at Other Outfalls ☐ Yes ☐ No ______ m

Distance either side of outfall

* Year to which data relates ____________
* Algal Blooms Observed ☐ Yes ☐ No ______ m
* Other Comments ____________________

3.4.3 Flora & Fauna Impacts

Fauna
* Designated Salmonid Water ☐ Yes ☐ No ______ m
* Recognised Fish Sensitive Water ☐ Yes ☐ No ______ m
* Details ____________________
* Designated Shellfish Water ☐ Yes ☐ No ______ m
* Designated Shellfish Production Area ☐ Yes ☐ No ______ m
* Details ____________________
* Protected Species Present ☐ Yes ☐ No ______ m
* Details ____________________
* Other Comments ____________________

Flora

* Protected Species Present ☐ Yes ☐ No ______ m
* Details ____________________
* Other Comments ____________________

Data Supplied by: ____________________ Local Authority Engineer **Date** ____________

Compiled by: ____________________ JV Team Member **Date** ____________

Verified by : ____________________ JV Team Leader **Date** ____________

PART 4 - RECEIVING WATERS (B)

4.0.1 County___________________ Sanitary Authority________________

4.0.2 Scheme/catchment name _______________________________________

4.0.3 Name of Recipient Waters ______________________

4.0.4 O.S. Grid Ref of end of each outfall ______________________

4.1.0 HYDRAULIC DETAILS OF RECEIVING WATER

4.1.1 Nearest Measurement Station ______________________

4.1.2 Distance from outfall to measurement station ______________________

4.1.3 Type of measurement station ______________________

4.1.4 River Flowrate

* Dry Weather Flowrate ______________________
* 95 %ile Flowrate ______________________

4.1.5 Coastal & Estuarine Waters

* Modelling Data Available Y ☐ N ☐

4.1.6 Freshwater Lake

* Volume of lake ______________________
* Flow out of lake ______________________

4.2.0 QUALITY OF RECEIVING WATER

4.2.1 EPA Monitoring

* Classified — Y ☐ N ☐
* Year to which data relates
* Biological Q Rating in last EPA Report — Q1 | Q2 | Q3 | Q4 | Q5
* Improvement on Previous Assessment — Y ☐ N ☐
* Target Q Rating — Q1 | Q2 | Q3 | Q4 | Q5
* Other Comments ____________________

4.2.3 Sensitivity Designation

* Designated Sensitive Under Urban Waste Water Treatment Regulations — Y ☐ N ☐
* Designated Sensitive Under Phosphate Measures Report/Phosphate Regulations — Y ☐ N ☐
* Other Comments ____________________

4.3.0	**Other Designations**				Distance either side of outfall
4.3.1	SAC	Code________	Y ☐	N ☐	____m
4.3.2	NHA	Code_______	Y ☐	N ☐	____m
4.3.3	pNHA	Code_______	Y ☐	N ☐	____m
4.3.4	SPA	Code________	Y ☐	N ☐	____m

Data Supplied by: ____________________ Local Authority Engineer **Date** ________________

Compiled by: ____________________ JV Team Member **Date** ________________

Verified by : ____________________ JV Team Leader **Date** ________________

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

2.2 SEWERAGE NETWORK QUESTIONAIRE

April 2002

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

2.2 SEWERAGE NETWORK QUESTIONNAIRE

Issue Record:

Issue No.	Description/ Status	Prepared By	Checked By	Verified By	Date
1	For Approval	T. Curran/ D. McHugh/ M. Morris	T. Robson	I. Aikman	January 2002
2	For Issue (Pilot)	D. Ward/M. McDaid	T. Robson	I. Aikman	February 2002
3	For Issue (Main Survey)	D.Ward	T. Robson	I. Aikman	April 2002

County:____________________

Sanitary Authority:________________________

Catchment Name:____________________

Catchment Number:____________________

Catchment Outfall OS Grid Ref: ____________________ Code: _____________
(Ref for sewer outfall to treatment works or receiving water if no works)

CONTACT DETAILS

Contact Name			
Position			
Address			
Telephone No.			
Fax. No.			
Mobile No.			
E-Mail Address			

NOTES:
1. Comprehensive notes on the completion of this questionnaire and sample maps are contained in the booklet "*Questionnaire Methodology"*.
2. The baseline date for information supplied in this questionnaire is to be 2002; where data supplied is to a different datum, please indicate the date.
3. The project has a 20-year planning horizon, i.e. horizon year is 2022

1. CATCHMENT & DEVELOPMENT DATA

1.1 **General description of the catchment and networks**: Population and character of development inc. major industries, topography, geology & soils, pollution or flooding, type of systems and indicative development history (particularly recent history).

No.	Information request:	Data Available	Data Base Year*	Source Code
1.2	Map similar to example map 1 showing overall boundaries of existing drainage catchment and the existing development area.	Y/N		
1.3	Map similar to example map 2 showing current development areas by sector.	Y/N		
1.4	Map similar to example map 3 showing future development areas by sector indicating planning horizon/target year.	Y/N		
1.5	Copy of the latest County Development Plan.	Y/N		
1.6	Area of the catchment served by public sewers	Ha		
1.7	Area of the catchment served by private sewerage facilities	Ha		
1.8	Number of households in the catchment	No.		
1.9	Number of households connected to the Public Sewer Network	No.		

* Data Base Year is the year to which the basic data relates, ie. future estimates may be based on base population census data collected in 1996 or on estimates made in 1999.

2. POPULATION

No.	Information request	Data Available	Data Base Year	Source Code
2.1	Resident winter catchment population (2002)	Persons		
2.2	Approximate peak population (2002) *	Persons		
2.3	Estimated peak population in 2022**	Persons		

* Source of this figure should be identified.
** An indication/explanation on how this figure was calculated should be provided.

3. ASSET INVENTORY AND NETWORK INTEGRITY

General Network Data

No.	Information request	Data Available	Data Base Year	Source Code
3.1	Drainage network plan showing trunk sewer and ancillaries (e.g. pump stations, overflows), similar to example map 4.	Y/N		
3.2	Identification on plan the types of system used i.e. separate, combined or partially combined areas.	Y/N		
3.3	Mark on plan pipe diameter and limiting gradient of each trunk sewer just upstream of the WWTP (Further details requested in 3.14).	Y/N		
3.4	Mark up plan giving location of past flooding, blockages, watercourse pollution, similar to example map 5.	Y/N		

Permanent Monitors

No.	Information request	Data Available	Number	Data Base Year	Source Code
3.5	Number of permanent flow monitors installed on the public network	Y/N			
3.6	Number of permanent rain gauges installed on the public network	Y/N			
3.7	Number of permanent water quality loggers on the public network	Y/N			

Database & Hydraulic Model Files

No.	Information request	Data Available	Data Base Year	Source Code
3.8	Copy of network database if available & indicate format/software (preferably as an electronic files)	Y/N Format?		
3.9	Copy of hydraulic model and output files if available, indicating format/software used.	Y/N Format ?		

3.10 SEWER NETWORK - FOUL GRAVITY SEWERS

Information Requested	**Data available Sewer Length in each Diameter Range (mm)**				**Data Base Year**	**Source Code**
	$\phi \leq 225$	**$225 < \phi < 600$**	**$\phi \geq 600$**	**Total (all dia.)**		
Total Length(m)						
Material:-						
% Concrete						
% Other						
% Other						
Sewer Condition	$\leq$ Grade 3	Grade 4	Grade 5			
% all sizes in each Grade *						
Manholes (no)						

* Refer to Methodology for description of Grading

** Shaded areas not to be completed

3.11 SEWER NETWORK – STORM GRAVITY SEWERS

Information Requested	Data available Sewer Length in each Diameter Range				Data Base Date	Source Code
	$\phi \leq 225$	**$225 < \phi < 600$**	**$\phi \geq 600$**	**Total (all dia.)**		
Total Length(m)						
Material:-						
% Concrete						
% Other						
% Other						
Sewer Condition	< Grade 3	Grade 4	Grade 5			
% all sizes in each Grade						
Manholes (no)						

* Refer to Methodology for description of Grading
** Shaded areas not to be completed

3.12 SEWER NETWORK – COMBINED GRAVITY SEWERS

Information Requested	Data available Sewer Length in each Diameter Range				Data Base Date	Source Code
	$\phi \leq 225$	**$225 < \phi < 600$**	**$\phi \geq 600$**	**Total (all dia.)**		
Total Length(m)						
Material:-						
% Concrete						
% Other						
% Other						
Sewer Condition	< Grade 3	Grade 4	Grade 5			
% all sizes in each Grade*						
Manhole (no)						

* Refer to Methodology for description of Grading
** Shaded areas not to be completed

3.13 SEWER RISING MAINS

Information request	Data available Sewer Diameter Range			Data Base Date	Source Code
	$\phi \leq 225$	**$225 < \phi < 600$**	**$\phi \geq 600$**		
Total Length (m)					
Material:-					
% Plastic					
% Ductile Iron					
% Other					
% Foul mains					
% Combined mains					
Rising Main Condition	≤ Grade 3	Grade 4	Grade 5		
% all sizes Plastic					
% all sizes Ductile					
% all sizes Other					

3.14 TRUNK SEWERS LEADING TO WWTP

Description	Capacity (l/s)	Diameter (mm)	Gradient	Roughness, k, (mm)	Source Code

3.15 What is the largest diameter sewer in the network ? …………………… mm.

3.16 COMBINED STORM OVERFLOW (CSO) – NOT INCLUDING EMERGENCY OVERFLOWS FROM PUMPING STATIONS

CSO Location/Ref. *						
Method of screening or solids separation **						
Condition of civil/ building works (1-5)						
Condition of M&E works etc (1-5)						
Performance of CSO (1-5)						
Name of receiving water						
Data Base Date						
Source Code						

* Confirm that each CSO is as shown on the Map referred to in Question 3.1
** H = Hand raked bar screens
M= Mechanically raked screens
D = Dynamic separation
O= Other system

3.17 WATERCOURSE POLLUTION

Location	Frequency	Source (Storm or Emergency overflow / etc)	Extent	Source Code

3.18 PUMPING STATIONS*

Location	Operating Capacity (l/s)	Emergency Overflow (Y/N)	Structural Condition (1-5)	M&E Condition (1-5)	Data Base Date	Source Code

***** Ensure that all pump stations are shown on MAP 4

3.19 OTHER ANCILLARIES: (SIPHONS, STORM ATTENUATION FACILITIES, ETC.)*

Location and Type Description	Capacity (l/s or m^3/d)	Structural Condition (1-5)	M&E Condition (1-5)	Data Base Date	Source Code

*** Ensure that all above ancillaries are shown on MAP 4.**

4. OPERATIONAL CONTROL & STAFFING STRUCTURE

4.1 Please describe the Staffing Structure in place to operate and maintain all aspects of the sewer network as a percentage of the yearly time, to include Engineers, Technicians, Caretakers, Administrators etc. Please also supply an organogram to describe it (see example in Guidance Notes).

4.2 Please describe the Operational Control of the Network to include telemetry / SCADA system, remote monitoring systems, control of pumping stations and valves, frequency of site visits etc.

5. EXISTING SURVEYS

5.1 SURVEYS

Survey Type	Year of Survey	Sewer Survey Coverage (m)*	Quality Control checks carried out (Y/N)	Quality Acceptable (Y/N)	*Map of Survey & output available (Y/N)	Number of Monitors (Nr.)	Results/ Reports Available (Y/N)
CCTV Survey (1)							
CCTV Survey (2)							
CCTV Survey (3)							
CCTV Survey (4)							
Impermeability Survey							
Flow & Rainfall Survey							
Manhole Survey							
Other (Please Specify)							

* Provide maps indicating:

(a) the extent of surveys or location of monitoring points
(b) the extent of surveyed sewers in condition grades 4 or 5

6. ADEQUACY OF EXISTING SYSTEM

6.1 HYDROLOGY

Any extreme storm event since 1990 (Y/N)	Date	Indicative Return Period of the event	Did Flooding Result (Y/N)	General Location of flooding	Source Code

6.2 SEWER FLOODING

Location*	Return Period / Frequency	Cause (capacity limitation / blockage)*	Sewer Type (separate / combined / etc)	Extent of sewer flooding	Verified by Hydraulic Model Analysis (Y/N)	Source Code

* Please provide the following:
- Map or list of streets where sewers are know to be under capacity
- Indicate where there is overcapacity relative to current demand.

6.3 SEWER STRUCTURAL FAILURES

Location (Street)	Cause	Sewer Type (separate / combined / etc)	Extent	Source Code

6.4 OTHER MAJOR FAILURES

Structure	Location	Cause	Frequency	Extent	Source Code

6.5 CAPITAL WORKS

Please provide details (type, location/extent & indicative value) of Capital Schemes carried out on the network in the recent past, plus current and proposed Schemes. Indicate whether or not the proposal has received financial approval and planned dates (if available) for commencement and commissioning of proposed works.

6.6 SEWER MAINTENANCE PROBLEMS

Please provide details of maintenance work carried out on the network in the recent past, currently on-going and/or planned for the near future.

7. POTENTIAL SOLUTIONS

7.1 PLEASE LIST INTENDED SOLUTIONS TO THE PROBLEMS LISTED IN 6.1 TO 6.4 ABOVE.

Problem No.	Solution

Data Collected by: ___________________________________ Date:________________
(signature of JV team member)

Data Confirmed by: ___________________________________ Date: _______________
(signature of local authority representative)

Data Checked by: ___________________________________ Date: _______________
(signature of JV team member)

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

2.3 DATA COLLECTION GUIDANCE NOTES

Issue Record

Issue No.	Description/ Status	Prepared By	Checked By	Approved By	Date
1	Draft A	J. Kelleher	J. Kelleher	I. Aikman	January 2002
2	Draft B	T. Curran	T. Robson	I. Aikman	February 2002
3	Final C	D. Ward	T. Robson	I. Aikman	April 2002

TABLE OF CONTENTS

SECTION A – DATA COLLECTION METHODOLOGY

1.0 Data Collection Methodology

1.1 Data Collection Questionnaires

The waste water treatment and sewerage questionnaire was prepared for issue to the relevant contact personnel in each of the local authorities. It seeks all the information necessary to assess and evaluate the schemes. It is set out in four parts as follows:

- Sewerage Network
- Scheme Loading and Flow
- Waste Water Treatment Plant
- Receiving Waters

For the purposes of the data collection process it has been formatted as two separate documents

- Sewerage Network Questionnaire
- Waste Water Treatment Questionnaire which contains the sections on Scheme Loading and Flow, Wastewater Treatment Plant, and Receiving Waters

Shortly after the questionnaires have been issued, the survey teams will contact the local authorities by telephone to answer any queries, to provide assistance with completion of the questionnaires and to arrange a meeting with the relevant engineer with overall responsibility for each scheme. The survey team should also ask what information is not available in the local authority office (e.g. hydrological or water quality data which could be obtained from EPA publications, or location of NHAs etc which could be obtained from Duchas).

Due to the extent of information requested, this meeting is essential to ensure that all of the information requested is provided, that it is unambiguous, and in the appropriate format requested. It is also essential that the designated local authority individual checks and verifies all data provided and inserted in the questionnaire. The questionnaires will also be checked by the survey team. Following this meeting the survey team will then visit the wastewater treatment facilities serving each sewerage scheme. Data and information provided at the meeting will be verified and cross-checked on site. In instances where site layout drawings or process flow diagrams are unavailable or not provided these will be drawn on site.

It is also intended that the survey teams will meet with personnel from the planning department of each local authority to establish future development policies and to determine future population figures for each catchment area.

If information requested by the survey team is not provided by the local authority within a designated time frame, then it should be recorded as “not available”.

1.2 Completion of the Questionnaire

Sections 2 and 3 below set out the information and data necessary to complete the questionnaire, as well as the source of such data and information. The same numbering system used in the questionnaires is used in these sections.

In all cases the source of each item of information should be recorded and the Data Source Codes provided in Table 1.1.used to indicate the reliability of the information. Where appropriate, asset condition should be recorded using the numerical Condition Gradings given in Tables 1.2 to 1.4.

If a particular treatment stage is not provided insert N/A – Not Applicable.

Table 1.1
Data Source Code

Source Code*	**General Meaning**
1	**Waste Water Treatment Plant**: *As-built* dimensioned plans, not more than 5 years old, are available and confirmed on site by the JV Team who also review operations with the operator/caretaker. Site measurement could take the place of dimensioned plans only if depth and shape of tanks can be determined on site. Good operational records available. **Sewerage System**: Reasonably comprehensive current survey plans and records available and confirmed to have passed standard quality assurance checks, plus on-site confirmation by the Team of at least two key features eg. major storm overflows. Alternatively, a catchment rehabilitation report has been prepared and accepted for action and/or a verified sewerage system model is available **Other Data:** Information derived from comprehensive records and databases (cover all parameters) which have been prepared not earlier than Q1, 2001. Measured, rather than estimated, values are available for parameters which are commonly measured. The data has been or can be updated to the required year(s) with soundly based information e.g. current planning reports.
2	As for 1 above, but minor shortcomings. Examples include some older or incomplete records or surveys or a minor item of data which is estimated based on sound information. This should be backed up by a good knowledge of the system by the operator/manager.
3	**Waste Water Treatment Plant**: Drawings of plant more than 5 years old and not confirmed as, *as-built* drawings. Site measurement carried out with estimates of below ground/below water level dimensions and shape, based on standard designs. Schematic drawings of the facility available but operational records poor/incomplete. Inspection reports within the past 5 years showing the facility to be in operational order. Basic operational details derived from discussion with operator/caretaker. **Sewerage System**: Drawings of the trunk sewerage system are more than 5 years old. Limited recent survey data available, ie. within last 5 years. Reasonable knowledge of the system by O & M staff. Failure or defect data does not conflict with sewer records. **Other Data**: Information derived from records and databases prepared within the last 5 years but which may not be complete. Estimated values used in place of measured data appear to be soundly based.
4	**Treatment & Sewerage Assets**: Few records and/or drawings available. Sketchy knowledge of current system, its condition and performance, eg. marine treatment, based on a long sea outfall system, where no site measurement is possible. **Other Data**: Few records and/or drawings available. Sketchy knowledge of the current flows and loads or future development.
5	**Sewerage and/or Treatment Assets**: No existing knowledge of the facilities other than acknowledgement of their existence. Estimates based on catchment characteristics and typical average values. **Other Data**: No formal records available; estimates based on comparable catchments and typical values.

* The term "Source code" is synonymous with the term "Confidence Grade" as used in the catchment reports.

Table 1.2
Asset Condition Grading for Gravity Sewers

Asset Grade	Description	**General Meaning**
1	**Excellent**	No Structural Defects
2	**Good**	For Brick Sewers: Minor cracking; No deformation or loss of bricks; Mortar loss confined to surface; Line and level as built; Connections satisfactory. For Other Sewers: Circumferential cracking; Moderate joint defects
3	**Moderate**	For Brick Sewers: Deformation 0-5%, no fracture and only moderate loss; Displaced bricks; Total mortar loss without other defects; Occasional defective connections For Other Sewers: Deformation 0-5% and cracked or fractured; Longitudinal/multiple cracking; Occasional fractures; Severe joint defects; Minor loss of level; Badly made connections
4	**Borderline**	For Brick Sewers: Deformation 5-10% and fractured or total mortar loss; Small number of missing bricks; Displaced/hanging brickwork; Frequently badly made connections; Dropped invert For Other Sewers: Deformation 5-10% and cracked or fractured or broken; Serious loss of level
5	**Fail**	For Brick Sewers: Already collapsed; Deformation > 10% and fractured; Extensive ares of missing bricks; Displaced/hanging bricks; Missing invert For Other Sewers: Already collapsed; Deformation > 10% and cracked or fractured or broken; Extensive areas of missing fabric

Table 1.3
Asset Condition Grading for Pumping Mains

Asset Grade	Description	General Meaning
1	**Excellent**	Smooth bored mains not subject to corrosion or with sound factory applied linings, no operational problems
2	**Good**	As 1, but with loose deposits that are noticeable under abnormal flow conditions, slight tuberculation which may give a rough surface, but does not substantially reduce the CSA of the pipe. May require routine flushing or de-silting.
3	**Moderate**	Some problems with loose deposits or deterioration of linings leading to occasional blockage. History of occasional pipe blockage with tuberculation causing up to 20% blockage by encrustation.
4	**Borderline**	Frequent problems causing blockage on more than one occasion under normal operating condition during previous twelve months. Mains with tuberculation causing 20-40% blockage by encrustation.
5	**Fail**	Mains suffering severe problems of blockage. Pumping performance cannot be ensured. Mains with tuberculation causing 60-80% blockage by encrustation.

Table 1.4
Asset Condition Grading for Above Ground Assets

Asset Grade	Description	General Meaning
1	**Excellent**	Sound modern structure with modern mechanical and electrical plant and components that are operable and well maintained.
2	**Good**	As 1, but showing some minor signs of deterioration. Routine refurbishment and maintenance required with review of condition in the medium term (within 5 years).
3	**Moderate**	Functionally sound, but appearance significantly affected by deterioration, structure is marginal in its capacity to prevent leakage, M&E plant and components function adequately but with some reduced efficiency and minor failures. Review of condition required in the medium term.
4	**Borderline**	Deterioration has a significant effect on performance of asset, due to leakage or other structural problems, M&E plant and components function but require significant maintenance to remain operational. Will require major overhaul/replacement within medium term.
5	**Fail**	Serious structural problems having a detrimental effect on the performance of the asset. Effective life of M&E plant and components exceeded and incurring excessive maintenance costs compared to replacement cost due to unreliability. Will require major overhaul/replacement in short term.

SECTION B – WASTE WATER TREATMENT PLANT

1.0 Flow & Load Methodology

1.0.0 General Information

The general information sought can be filled in prior to despatching the questionnaire to the relevant Local Authority.

1.1.0 Waste Water Treatment Plant Contact Details

1.1.1 Details of the plant location should be provided by the Local Authority. If there is more than one waste water treatment system serving the catchment, then a second questionnaire should be completed.

1.1.2 The primary contact will be the Engineer with responsibility for either the network or the treatment aspect of the scheme. The contact should be familiar with the scheme and its history. The name and contact details of the plant caretaker should also be provided.

1.1.3 The position held by the Local Authority Engineer with responsibility for either the network or the treatment aspect of the scheme should be inserted here.

1.1.4 The Local Authority shall provide directions to the Waste Water Treatment Plant from regional and secondary roads and from any local landmarks.

1.1.5 The Waste Water Treatment Plant Ordnance Survey grid reference to be provided by the Local Authority shall relate to the location of the inlet to the Treatment Works.

1.2.0 Current Waste Water Loading (2002)

1.2.1 The Local Authority shall provide current waste water loading for each parameter shown. A box is provided beside each parameter to clarify whether this parameter has been measured or is a best estimate by the Local Authority. 1 PE is defined as the organic biodegradable load having a BOD_5 of 60 g/day calculated on the basis of the maximum average weekly load entering the treatment plant during the year, excluding unusual situations such as those due to heavy rain.

1.2.2 The Domestic constituent shall be given in terms of dry weather flow (DWF, m^3/day) and biochemical oxygen demand (BOD, kg/day). This shall be provided either as measured or a best estimate by the Local Authority. The method of estimating the DWF and BOD should be explained.

1.2.3 The Industrial constituent shall be given in terms of dry weather flow (DWF, m^3/day) and biochemical oxygen demand (BOD, kg/day). This shall be provided either as measured or a best estimate by the Local Authority. The method of estimating the DWF and BOD should be explained.

1.2.4 The Commercial constituent shall be given in terms of dry weather flow (DWF, m^3/day) and biochemical oxygen demand (BOD, kg/day). This shall be provided either as measured or a best estimate by the Local Authority. The method of estimating the DWF and BOD should be explained.

1.2.5 The institutional constituent shall be given in terms of dry weather flow (DWF, m^3/day) and biochemical oxygen demand (BOD, kg/day). This shall be provided either as measured or a best estimate by the Local Authority. The method of estimating the DWF and BOD should be explained.

1.2.6 The Tourism constituent shall be given in terms of dry weather flow (DWF, m^3/day) and biochemical oxygen demand (BOD, kg/day). This shall be provided either as measured or a best estimate by the Local Authority. The method of estimating the DWF and BOD should be explained.

1.2.7 The Local Authority shall provide details on Imported liquors transported to the site. These shall include leachate and shall be expressed in terms of m^3/week and kg BOD/week.

1.2.8 Details of Imported sludge's transported to the site shall be provided by the Local Authority. These shall be expressed in terms of m^3/week and kg dry solids/week. The sludge liquors contribution shall be included at a BOD concentration of 3,000 mg/l. If the plant under consideration forms part of a satellite station or a hub centre under a Sludge management plan these volumes should be readily available.

1.3.0 Future Waste Water Loading (2022)

1.3.1 Future waste water loading in 2022 for each parameter shall be provided by the Local Authority, or in the case where it is not, it shall be estimated. Not all areas will develop at the same rate so it will be advantageous to obtain planners estimates. The County Development Plans which indicate the areas likely to be developed will have been produced in consultation with the planning section of the respective Local Authorities.

1.3.2 The domestic future loading should be consistent with the population projection for 2022 provided in the sewerage network questionnaire (question 2.3). The method of estimating the DWF and BOD should be explained.

1.3.3 The future daily Industrial DWF/BOD loadings should reflect the changes planned and projected by the Planning Department. The method of estimating the DWF and BOD should be explained.

1.3.4 The future daily Commercial DWF/BOD loadings should reflect the changes planned and projected by the Planning Department. The method of estimating the DWF and BOD should be explained.

1.3.5 The future daily Institutional DWF/BOD loadings should reflect the changes planned and projected by the Planning Department. The method of estimating the DWF and BOD should be explained.

1.3.6 The future Tourism DWF/BOD loadings should reflect the changes planned and projected by the Planning Department. The method of estimating the DWF and BOD should be explained.

1.3.7 Details of imported liquors transported to the site should be estimated by the Local Authority. These should include leachate to be imported from landfill sites where applicable. The basis of the estimate should be explained.

1.3.8 Details of Imported sludge's transported to the site shall be provided by the Local Authority. If the plant under consideration forms part of a satellite station or a hub centre under a Sludge Management Plan these volumes should be readily available.

1.4 Special Characteristics

If any of the following give rise to specific problems at a Waste Water Treatment Plant, the Local Authority shall provide the relevant details.

1.4.2 Oils, Fats & Greases (OFG)

OFG is generally a term used to include the fats, oils, greases and waxes of plant or food based origin present in waste water. OFG's are lighter than water and virtually insoluble, causing films and emulsions on the water surface and reducing atmospheric re-aeration.

1.4.3 & 1.4.3 Acids & Alkalis

Alkalinity in waste water results from the presence of the hydroxides, carbonates and bicarbonates of elements such as calcium, magnesium, sodium, potassium or ammonia. The alkalinity in wastewater helps to resist changes in pH caused by the addition of acids. Waste water is normally alkaline, receiving its alkalinity from the water supply, the ground water, and the materials added during domestic use.

1.4.4 Nitrification Inhibitors

Nitrification is the oxidation of ammonia to nitrite and nitrate. Various factors, which inhibit this process, are as follows:

- Low pH
- Low mechanical Oxygen transfer
- Influent from industries (namely abattoirs and dairies).

1.4.5 Infiltration

Is there evidence of infiltration into the sewer flows

1.5.0 Surface or Storm Water Loading

1.5.1 The peak flow into the treatment works should be given in litres per second (l/s), and the source of this data should be confirmed as measured or estimated. This is to define whether the system is a combined system (foul & surface water) or a separate system (foul water only).

All sewerage systems receive some level of stormwater inflow. In a combined system, sewerage flows can increase dramatically following rainfall with peak flows up to 30 DWF.

1.6.0 Non Domestic Discharges

Non-domestic discharges are licensed in two ways: by IPC license issued by the EPA or by Section 16 License issued by the Local Authority.

IPC Licensing
The Environmental Protection Agency (EPA) has the sole responsibility for issuing and enforcing all IPC licences. The Integrated Pollution Control approach to licensing dictates that a single integrated licence will be issued to a facility to control wastewater pollution. The EPA Act, 1992 enacted on the 23 April 1992, established a new institutional framework for the control of environmental pollution in Ireland. In addition to other functions, the EPA is responsible for the IPC licensing of large or complex activities with significant polluting potential listed in the first schedule to the EPA Act, 1992.

Under the EPA licensing regulations, 1994 (S.I. No. 85 of 1994), the licensing function of the Agency commenced on the 16 May 1994 and was made operational on a phased basis.

Section 16 Licensing
Notwithstanding the above the Local Authorities are responsible for the licensing and control of activities that do not come within the scope of IPC licensing

1.6.1 The Local Authority is requested to provide the name of the Company and all relevant parameters of the company's effluent, which have been licensed with EPA (IPC Licenses) or Local Authority (Section 16 Licenses) discharging directly to the Waste Water Treatment Plant or into the sewerage network.

1.6.2 In accordance with the "polluter pays principle" as set down in National and E.U. policy, non-domestic users will be required to meet the capital and operating costs of facilities and services provided for their use. Based on this principle capital contributions must be sought from non-domestic users to cover the full marginal cost of waste water treatment provided for them. The Local Authority should indicate whether or not a Polluter Pays Principle Report has been prepared for the scheme.

1.6.3 If a polluter pays principle report has been prepared for the Local Authority the list of contributing companies listed in sections 1.6.1 and 1.6.2 should be checked against the companies listed in the report by the Local Authority.

1.6.4 If a polluter pays principle report has been prepared and is not consistent with that list provided in sections 1.6.1 and 1.6.2, the afore mentioned tables shall be amended.

1.6.5 The Local Authority should indicate if any of the Industrial contributors are subject to large seasonal peaks or troughs.

1.6.6 If the answer to 1.6.5 is yes the Local Authority need to identify at what time of year these fluctuations of flow occur. These Industrial contributors seasonal peaks or troughs should be provided as requested in the table.

1.7.0 Imported Sludges

1.7.1 This section deals with any sludge's brought to the site, either to a sludge reception centre or added directly to the process. This shall be completed by Local Authority.

1.7.2 If the answer to 1.1.7 is "Yes" then complete sections 1.7.3 and 1.7.4

1.7.3 The sludge imported onto the site is to be quantified in terms of volumes generated per week (m^3) and is to be completed by Local Authority. The source code of this information should be graded.

1.7.4 The sludge imported to site is to be defined in terms of % dry solids and is to be completed by the Local Authority. The source code of this information should be graded.

1.7.5 Indigenous sludge is sludge, which is generated on site as the result of the particular Treatment process employed at the Waste Water Treatment Plant Site.

1.7.6 The sludge generated on-site by the Treatment Plant is to be quantified in terms of volume generated per week (m^3) and is to be completed by Local Authority. The source code of this information should be graded.

1.7.7 The sludge generated on-site by the Treatment Plant is to be quantified in terms of volume generated per week (% dry solids) and is to be completed by Local Authority. The source code of this information should be graded.

1.8.0 Treated Effluent Quality

1.8.1 Insert the treated effluent quality required design standards. Below are typical required standards set out in S.I. No. 254 of 2001:*Urban Waste Water Treatment Regulations 2001:*

Concentrations

Biochemical Oxygen Demand (BOD5) – 25mg/l O_2
Chemical Oxygen Demand (COD) – 125mg/l O_2
Total Suspended Solids (SS) – 35mg/l

Discharge to Sensitive Areas

Total Phosphorous – 2mg/l (10,000 – 100,000 pe)
1mg/l (> 100,000 pe)

Total Nitrogen – 15mg/l (10,000 – 100,000 pe)
10mg/l (>100,000 pe)

1.8.2 Insert the actual effluent quality leaving the Urban Waste Water Treatment Plant. This in most cases is measured by the Local Authority at the outlet of the Plant.

2.0 Waste Water Treatment Plant Process

2.0.0 General Information

The general information sought is no longer required as it has been provided in 1.0.0 of the Loadings and Flow Questionnaire.

2.1.0 Waste Water Treatment Plant Contact Details

This is to be provided in section 1.1.0 of the questionnaire.

2.2.0 General Site Information

2.2.1 – 2.2.3 should be answered by the local authority.

2.2.4 A site layout plan is required and should be provided by the local authority in electronic and paper format. It is important to record the year to which it applies.

2.2.5 If a site layout plan is not available from the local authority, then it should be drawn on site. Refer to Fig 2 in the Data Collection Guidance Notes for the format and level of detail required. Structures and process units should be drawn, with key dimensions and distances between structures shown on the drawing. For process structures, it is the internal dimensions that are relevant and these should be accurate to within 100mm. Measurements should be to water retaining faces so that volumes, flowrates, etc, can be derived from them.

In the interest of safety, measurements may be made by either measuring the outside faces of structures and deducting the wall thickness, or by measuring a straight line on the ground to the position of the faces. Considerable care will be required in the latter method to avoid errors greater than 0.1m.

Any site layout drawing provided should be checked on site with regard to any additional process structures on site constructed since the drawing was prepared. Critical structure dimensions should be checked to verify drawings, particularly if the drawings fall into the “moderately reliable to unreliable” categories.

2.2.6 A process flow diagram is required and should be provided by the local authority in electronic and paper format. It is important to record the year to which it applies.

2.2.7 If a process flow diagram is not available from the local authority, then it should be drawn on site. Refer to Fig 1 in the Data Collection Guidance for the format and level of detail required. The direction of flow between process units should be shown, as should the point at which all incoming effluents or sludges enter the treatment system, and the destination of all effluents or sludge leaving the site. Information should be provided by the site caretaker but verified by the designated engineer.

2.2.8 Any Process Flow Drawing provided should be checked on site with regard to any additional process units or process modifications made on site since the drawing was prepared. This is critical if the drawings fall into the “moderately reliable to unreliable” categories.

2.2.9 The year the original plant was commissioned should be inserted.

2.2.10 The year that the last major refurbishment was undertaken should be inserted, as should the date and outline of any subsequent plant extension or additions.

2.2.11 Local Authority to confirm the availability of detailed plant drawings and define the type of drawing available, ie. as-built or tender.

2.3.0 Preliminary Treatment

2.3.1 The provision or absence of preliminary treatment should be recorded.

2.3.1.1 The presence and category of screening should be recorded. In the absence of information provided by the local authority personnel the following standard assumptions can be made during visit to wastewater treatment plant.

Fine screening refers to bar spacing or aperture ≤ 6 mm

- Medium screening refers to bar spacing or aperture between 6 mm and 20 mm
- Coarse screening refers to bar spacing or aperture ≥ 20mm

The performance condition refers to whether it is functioning or not. It should be noted if rags or other materials are clearly visible floating in subsequent stages of the plant or in the receiving waters that the system is inadequate.

Screenings treatment refers to compaction, shredding and or washing.

2.3.1.2 Disintegration
This is a solids destruction process in which all solids are retained in the flow and not removed. A brief description is required only if the unit type is not listed above.

2.3.1.3 Grit Removal
If the type does not fall into either of the types listed, then a brief description should be given. If there are reports of a build up of grit or grit associated problems in subsequent stages of the treatment plant it should be noted.

2.3.1.4 Storm Tanks
This refers to the storage and settlement of storm water.

If the tank operating volume is not known or provided by the local authority personnel, then it can be calculated by measuring the tank diameter (or length and width) on site, (as per 2.2.5) and making an assumption with regard to the sidewall/water depth based on the following.

- If the tank is rectangular, assume that the floor is sloped gradually towards one end. If the water depth is unknown, take an average water depth of 2.2 m, with a floor slope of 1 in 40. (Ref 2). If the tank is not full, the top water level can be determined from the “tide” mark along the internal tank walls.

- If the tank is circular and fitted with a rotating scraper system assume a floor slope of 11 degrees.

The capacity of pumps refers to the combined output from all duty and assist pumps, and does not include the capacity of any standby pump.

2.3.1.5 It is possible that in-line storage or flow balancing upstream of the overflow to the storm tank may form part of the system. This may take the form of a tank sewer or a large diameter sewer in which flows are backed up before discharge. They occasionally give rise to problems such as deposition of solids. If such problems exist they should be noted.

2.3.1.6 Details relating to the type of Flow Measurement on the inlet to the Works and on the treated effluent outlet are required.

2.3.1.7 The presence of a sampling point at the inlet to the works should be recorded. In addition it should be noted whether this is an automated system or manual and whether regular sampling occurs.

2.3.1.8 This is particularly relevant where there is a significant industrial contribution to the treatment plant. (How effective or otherwise the process is will be determined in the data analysis stage of the project, when inlet and outlet monitoring data are compared, or if there are process problems reported in subsequent stages of the plant which could be caused by adverse pH conditions.). The method by which pH is corrected should be described.

2.3.1.9 This is particularly relevant where there is a significant institutional contribution in the load to the treatment plant. (How effective or otherwise the process is will be determined in the data analysis stage of the project, or if there are FOG deposits clearly visible downstream of this treatment stage, or if there are process problems reported in subsequent stages of the plant which could be caused by the presence of excess quantities of FOG.). The reason for installing FOG removal should be noted. The type of process used should be identified.

2.3.1.10 The use of chemicals at preliminary treatment stage for P removal should be noted. This may be a subsequent addition to a treatment plant and may not have been shown on plant drawings provided. If present it is important to state for which purpose it is installed. (How effective or otherwise the process is will be determined in the data analysis stage of the project, when inlet and outlet monitoring data are compared.)

2.3.1.11 The type of chemicals being used should be detailed.

2.4.0 Primary Treatment

2.4.1 The presence of a primary treatment process and its type should be recorded.

If tank dimensions are not provided by the local authority, the internal surface area of the tank should be measured as per 2.2.5. The operating depth can be determined using the following assumptions.

- If the tank is circular (radial flow) and fitted with a rotating floor scraper system assume a floor slope of 11 degrees and a water level at the side wall equivalent to one eighth of the internal tank diameter (Ref 3).

- If the tank is rectangular (horizontal flow), assume that the floor is sloped gradually towards one end. If the water depth is unknown, take an average water depth of 2.2 m, with a floor slope of 1 in 40. (Ref 2). If the tank is not full, the top water level can be determined from the “tide” mark along the internal tank walls.

- If the tank is a square or circular primary settlement tank (upward flow) without a sludge scraper system and with a diameter or sidewall length of up to 9 m – assume that it is hopper bottomed with a slope of between 45 and 60 degrees. (Ref 1) Use 52 degrees for volume calculation purposes. The straight wall section at the top would typically be 1.2 m approx. If the tank is not full, the top water level can be determined from the “tide” mark along the internal tank walls.

- If an Imhoff Tank is being used, then obtain the surface area of the settlement compartment by measurement if not provided by the local authority.

- If primary treatment is provided in the form of a septic tank the presence of a percolation area should be recorded. If not provided by the local authority, the operating volume can be obtained by measuring the plan area of the tank, making an allowance for wall thickness, and assuming an average water depth of 2.5 m (Ref 4).

- If a DAF (Dissolved Air Flotation) tank is used, and it has a flat floor, assume a liquid depth of 1.3 m. If the DAF tank has a hopper type floor, assume a floor slope of 30 ^{o}.

The total liquid surface area and the operational volume are the two critical parameters to be determined.

2.5.0 Secondary Treatment

2.5.1 The presence (or absence) of secondary treatment should be recorded, as well as the number of stages of secondary treatment and the number of tanks in each stage.

A plant is designed for carbonaceous removal only, if there is provision for BOD removal but not for nutrient removal.

Whether or not the plant is specifically designed to provide for nitrification should be recorded. If the caretaker is unsure it is reasonable to assume that nitrification is provided in an extended aeration system or oxidation ditch, while not provided in a conventional or high rate activated sludge system. The performance condition refers to whether the mechanical and electrical plant is functioning and its condition. The issue as to whether or not the process is effective will be dealt with in the data analysis stage of the project. (While an underloaded plant might currently be achieving full nitrificiation, it might not be capable of nitrificiation at loadings closer to the future plant load. By checking the ammonia, nitrite and nitrate concentrations in the treated effluent it can be established if nitrification is being achieved.)

The presence (or absence) of a designated denitrification zone should be recorded. This may take the form of a separate anoxic tank upstream of the main process, or may be present as an anoxic zone within an oxidation ditch. In the latter case if the wastewater and return activated sludge are added to the oxidation ditch at the position of the aeration system, then denitrification is not provided. If the return sludge and wastewater are both added some distance upstream of the aeration device in an oxidation ditch, then it can be assumed that denitrification is provided. (At the data analysis stage of the project this can be verified by checking the nitrate concentration in the treated effluent.)

The presence (or absence) of phosphorous removal should be recorded. It should also be noted whether this is achieved by chemical precipitation or biologically.

If some form of natural treatment (such as constructed wetlands or reed beds) is provided, it should be recorded, and whether it forms the first second or third stage of treatment.

The provision of a stabilisation process would include the use of lagoons.

The type of secondary treatment process should be recorded, in addition to whether it forms the first second or third stage of treatment. In the case of a two-stage plant where a similar technology is employed for both stages but in reactors of different volumes, details of the second stage should be provided on the left hand side of the page. The number and operating capacity of the reactors in each stage should be recorded.

Suspended Growth Processes

If the operating volume of the reactors is not known, the surface area can be measured, and the liquor level estimated based on the following assumptions;

- For an activated sludge reactor with a surface aerator, assume a width: liquor depth ratio of 4.0:1.0 (Ref 5), subject to a minimum depth of 2.2 m and a maximum of 4.5 m.
- For an oxidation ditch with surface aeration assume a channel width: liquor depth ratio of 2.0: 1.0, subject to a minimum depth of 2.2 m.
- For a conventional activated sludge reactor with diffused air aeration, the width: liquor depth ratio of 1.5:1.0 can be assumed, subject to a minimum depth of 3.5 m.
- For a membrane bio-reactor, assume a typical liquor depth of 3.5 m.

It is also necessary to record the total output of the duty aeration devices, preferably in kg O_2/hr. Failing that, it would be sufficient to obtain the total kW rating of vertical surface aerator, the total kW rating and rotor length of horizontal shaft aerators, or the total air output (in Nm^3/hr) of diffused air aeration blowers.

Attached Growth Processes

These refer to the biofiltration processes and variations thereof. The volume of media contained in the reactor is needed.

With regard to the media type it is necessary to record if it is a structured bed with plastic media and steel supports, or random packed with plastic media, or coarse stones etc. It is not necessary to record the shape of the media, i.e., raschig rings, saddles etc.

If sufficient dimensions are not provided the area of the top surface of the media and the depth of the media should be measured. For biofilters with structured plastic media an allowance should be made for the void space between the media and the side cladding on the structure.

With regard to the RBC (Rotating Biological Contactor) units, it is the surface area of the media which is important. This should be provided by the local authority and would be contained in the manufacturer's manuals. It is not possible to measure this parameter on site, or to make any standard assumptions since these are proprietary items of plant.

For BAF (Biologically Aerated Filters) the local authority should advise the surface area of the media. This is not possible to measure and is based on the manufacturers' specific unit surface area. It is also necessary to obtain the empty volume (to top water level) of the reactor.

If an anaerobic waste water treatment process is employed on site its type should be recorded, in addition to its operating capacity, and which stage of treatment it provides.

Details should be provided for both inter-stage and final sedimentation stages of treatment. Details of any inter-stage settlement should be provided on the left hand side of the page. There is no need to measure the depth of these tanks, since it is not critical to the performance of the plant.

2.6.0 Tertiary Treatment

2.6.1 The presence (or absence) of tertiary treatment should be recorded, as well as the type of tertiary treatment provided.

With regard to sand filtration, the surface area of the filter bed should be obtained. If this is not available, then it can be measured on site.

If disinfection of the treated effluent is provided, then the type and output should be recorded. If this is not provided, then it should be provided by the works caretaker from the manufacturer's manual.

2.7.0 Sludge Treatment

2.7.1.1 Sludge Thickening
The type of sludge thickening should be recorded for each type of sludge produced on site, i.e., humus, primary or surplus activated sludge. If more than one thickening process is provided on site details of each type and the sludge to which it applies should be recorded. The throughput of each thickener should be provided by the local authority, and expressed in terms of kg dry solids per hour. If throughput is only available in terms of m^3/hr being pumped to the thickener or m^3/hr leaving the thickener, the following assumptions can be made to estimate the throughput in the required terms.

- Unthickened waste activated sludge (WAS) will be at 0.75 % dry solids,
- Unthickened primary or humus sludges (PS) will be at 2 % dry solids
- If WAS is thickened in a Picket Fence Thickener it will be 4 % dry solids
- If WAS is thickened in a Gravity Belt Thickener it will be at 6 % dry solids
- If PS is thickened in a Picket Fence Thickener it will be at 6 % dry solids
- If PS is thickened in a Gravity Belt Thickener it will be at 8 % dry solids

2.7.1.2 Sludge Dewatering
The type of sludge dewatering system provided on site and the total number of units in operation should be recorded. It is important that the total throughput of the system is recorded in terms of kg dry solids per hour.

If the local authority is unable to provide this information, then the throughput can be estimated on the basis of the source of the feed sludge, the output (m^3/hr) of the duty pump feeding the dewatering unit, and using the assumptions provided in 2.7.1.1 above with regard to solids concentration in the feed sludge.

If the local authority is unable to advise the % dry solids achieved in the dewatered cake, then the following assumptions can be made with regard to the value achieved from different units when fed with different sludges;

	Primary	Secondary	P&S Mixed	Digested
• Single belt press	15	12	15	17
• Low pressure double belt press	16	15	16	18
• High pressure belt press	22	18	22	22
• Decanter centrifuge	22	18	20	25

Plate presses are not normally used for the dewatering of biological wastewater sludges, and therefore the required information should be provided by the local authority from either from measured values on operating experience or from the manufacturer's literature.

2.7.1.3 Advanced Treatment.
The provision of any forms of advanced sludge treatment should be recorded and also the operating capacity of the system in either kg ds/hr or kg ds/day. With regard to digestion this should be classified as either mesophillic anaerobic, thermophillic aerobic or other.

The storage capacity provided for treated sludge should be recorded even if no advanced sludge treatment is provided on site.

The reception facilities provided for any imported sludge should be described with reference to storage/flow balancing, screening etc.

2.7.1.4 Sludge Management Plan
Confirm is a Sludge Management Plan has been prepared which includes the study catchment.

2.7.1.5 If the Sludge Management Plan for this area has been prepared, its impact on this waste water treatment plant should be defined in terms of hub treatment centre, satellite centre, thickening and storage requirements etc.

2.7.1.6 Sludge Disposal
The current destination of sludge leaving the site should be recorded in terms of whether it is to another treatment plant for further treatment (name the plant), or if it is being disposed of to landfill (name landfill), or if it is being disposed of directly to agriculture, forestry etc.

Any future disposal plans shall also be listed. For five years and twenty years.

2.8.0 Ancillary Treatment

Any ancillary treatments (eg, supernatant treatment etc.) provided on site should be listed in this section.

2.9.0 Plant Ancillaries

2.9.1.1 The installation of odour control facilities should be recorded as well as the areas of the plant to which it applies.

2.9.1.2 The presence (or absence) of noise attenuation facilities on noisy areas of the site should be recorded as well as their effectiveness.

2.9.1.3 The type of plant control system should be noted in terms of whether there is just a standard motor control centre requiring significant manual input, or a high level of automation with a full SCADA system in place.

2.9.1.4 The presence of a standby electricity supply (eg, in the form of a generator) should be recorded with the proportion of plant systems which could be operated using it noted.

2.9.1.5 Any Health & Safety concerns should be highlighted either in terms of unsafe plant, structures or operating procedures.

Included in this section should be any comments in relation to the adequacy of chemical storage facilities with regard to bunding and H & S issues.

2.9.2 Minor Infrastructure

The condition grade for each of the following should be recorded.

2.9.2.1 Buildings (excluding small/non man entry plant covers)

- Administration/Control Buildings
- Sludge Building
- Air Blower Building
- Inlet Works Building
- Pump House
- Other (Name)
-

2.9.2.2 Surfaced Roads

2.9.2.3 Fencing

2.9.2.4 General Site Area (well maintained/drained etc)

2.10.0 Operation/Maintenance

A typical organogram is provided in the appendix and a similar type should be provided for the plant. In particular the amount of manhours spent on the plant by each grade and type of employee and activity, eg., for plant operation, laboratory analysis and reporting, general site maintenance, routine plant maintenance and repairs, supervision duties etc.

Any known significant operational problems should be listed together with the year to which they apply. If there are any planned modifications to rectify these, the status and timescale of such modifications should be recorded.

The presence of odour nuisance at the preliminary, primary, secondary and sludge treatment stages. Identify the location of the nuisance. Other issues could include recorded complaints from the public with regard to noise etc.

2.11.0 Capital Schemes/Potential Solutions

Any future or approved capital schemes or proposed solutions to operational problems or capacity shortfall should be listed and the following recorded.

- Brief description of the need (not more than one paragraph)
- Scale of proposed work – replace a tank, rebuild works, refurbish works etc.
- Indicative cost of works
- Indication as to whether or not the scheme has received financial approval
- Planned dates of commencement and of commissioning of proposed works.

3.0 Receiving Waters (A)

3.1.0 Receiving Waters

3.1.1 The name of each water body receiving a discharge from the scheme should be provided. In some cases the receiving water may be known by a different name to the name given on the O.S. maps. The EPA report on Water Quality in Ireland provides a list of water bodies with both their local names and the corresponding names use on O.S. maps. (Refer to Appendix A) In some of the larger population centres, where the sewerage network discharges directly to the receiving waters without undergoing treatment, there may be numerous contaminated outfalls (separate foul sewage, combined storm overflows or some treated effluent) discharging to different receiving waters, (e.g. to a major river and one of its tributaries). It is therefore important that the correct name be provided for each receiving water.

3.1.2 Each of the untreated waste water and combined storm overflows on the sewerage networks will have been identified in Section 3.14 of the Sewerage Network Questionnaire. The total number of each type should be inserted in this section. This type of information is necessary since more than one third of the schemes (representing approx. 42% of the waste water) do not receive secondary treatment. (Refer to EPA Urban Waste Water Discharges report for 1998/99)

3.1.3 The O.S. grid reference should be provided by the local authority for the major outfalls on each scheme, and will be verified by the locations marked on the sewerage network layout drawing. If unavailable, these could be obtained by the survey team from the Discovery Series Maps being used. (Accuracy to nearest 100 m is sufficient)

3.1.4 Each outfall should be categorised by type, i.e., approx. length, with diffuser, open ended, etc. (If discharging directly at a quay wall or onto a beach or shore above low tide, the length will be 0.)

3.2.0 Type of Receiving Waters

The information requested in this section could be supplied without difficulty by the local authority.

3.3.0 Resource and Amenity Value

3.3.1 The location of any drinking water abstraction downstream of the outfalls from this scheme should be provided by the local authority, together with the approximate distance from the outfalls.

3.3.2 The Blue Flag Beach and Marina status is an annual award organised by An Taisce (The National Trust for Ireland) with support from the Department of the Environment and Local Government and on behalf of FEEE (Foundation for Environmental Education in Europe). A list is published annually. The local authority would be aware of these, but the an Taisce list can be used for verification. (Refer to Appendix B for most recent list for year 2001. The 2002 list may be available when main field study is under way.)

Designated Bathing Area refers to designation under the Quality of Bathing Waters (Amendment) Regulations 1996, and the locations are listed in this legislation. (Refer to Appendix C)

Traditional bathing areas are those which are not covered by the above two categories, but where bathing traditionally takes place and should be identified by the local authority.

3.3.3 Other recreational activities would include water contact sports such as canoeing, boating etc. Blue Flag marinas are listed in Appendix B.

3.3.4 Details of fishing activities should be provided by the local authority, and should indicate if coarse angling, game fishing, salmon, etc.

3.3.5 This refers to the location of any known fish farms e.g., farmed freshwater fish, oyster or mussel beds, etc. If this information is not available from the local authority, it could be obtained from Bord Iascaigh Mhara (BIM) directory, but this should not be necessary since the local authority personnel being interviewed are those familiar with the catchment and scheme.

3.4.0 Quality of Receiving Waters

3.4.1 The local authority may have monitoring information available for the receiving waters relating to the concentration of certain parameters such as BOD, COD, DO, Phosphate, Ammonia, Nitrate, Total and Faecal Coliforms etc. The date and location to which this data applies should be stated. If regular monitoring is not undertaken by the local authority, then state this in the questionnaire and that the information is not available.

3.4.2 This section refers to any written reports of pollution in the river associated with waste water discharges. If the reports are anecdotal only, then confirmation should be obtained from at least three sources and verified by a written account. The year to which these reports relate should be stated specifying if any subsequent remedial action was taken, or improvements made to the drainage or treatment system.

3.4.3 The Salmonid Water Designation refers to designation under the Quality of Salmonid Waters Regulations 1988. A list of designated waters obtained from the Irish Statute Book 1922 – 1998 © Irish Government 1999 is included in Appendix D. Of particular relevance are the nutrient limits which will impact on the wastewater treatment level to be provided.

The “Fish sensitive waters” refers to known spawning areas which are not necessarily listed in the legislation, but will be known to the local authority, and the Fisheries Board.

The Designated shellfish waters are covered by the Quality of Shellfish Waters Regulations 1994 (S.I. No. 200 of 1994), and are listed in Appendix E. Faecal Coliform concentration is the most critical parameter in this regard. There are other waters, not designated under this legislation, but which are Shellfish Production Areas and come under EU legislation relating to the placing of mussels on the market. The presence of these areas in the vicinity of scheme outfalls should be known to the local authority personnel.

The question relating to “Protected Species” refers to classification under the Habitats Directive or Wildlife Act. This would cover for instance freshwater pearl mussels found near Oughterard in Co. Galway. The legislation does not appear to specify water quality standards for these areas, but we would generally apply the same water quality standards as for salmonid waters. The presence of this classification will therefore impact on the waste water treatment level to be provided.

If the local authority is not aware of any protected flora species present, and the area is not listed as a NHA, SAC, SPA etc by Duchas – then it should suffice to state so.

4.0.0 Receiving Waters (B)

4.1.0 Hydraulic Details of Receiving Waters

4.1.1 – 4.1.4 Having been advised of the name of the receiving waters and the OS Grid Reference of each of the outfalls the hydraulic information is readily available from the Hydrological Data published by the EPA. A copy of this report should be taken by the survey team to the meeting with the local authority to enable the nearest measurement station to be located and identified, and the relevant data extracted from the report. This is necessary since the local authority personnel are required to verify information inputs to the questionnaire. (The source of the data will be written into the questionnaire by the survey team.)

Where there is not a listing in this report for a measurement station close to the scheme discharge, the information may be obtained from the EPA. Where the measurement station is listed as using a staff gauge, the EPA report advises on the estimated 95% ile and dry weather flows.

4.1.5 The local authority should know if modelling data is available for the receiving waters.

4.1.6 Information on the freshwater lakes can be similarly obtained from EPA published data.

4.2.0 Quality of Receiving Water

4.2.1 Information on the results of EPA monitoring can be obtained from the current Report on the Biological Survey of River Quality published by the EPA. A copy of this report should be taken by the survey team to the meeting with the local authority to enable the nearest sampling point to be located and identified, and the relevant data extracted from the report. This is necessary since the local authority personnel are required to verify information inputs to the questionnaire. (The source of the data will be written into the questionnaire by the survey team.)

The target Q rating refers to the requirement under the Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations 1998 for water quality to meet specified biological water quality ratings. (Refer to Appendix F)

4.2.3 Sensitivity Designation
There are 39 water bodies which have been designated as sensitive for the purposes of urban waste water treatment and these are listed in the Urban Waste Water Treatment Regulations, 2001 (S.I. No. 254 of 2001). A list of these is provided in Appendix G.

The Phosphate Measures Reports for each county also identifies water quality improvements to be achieved in its area.

4.3 Other Designations

These are areas designated by Duchas and a full list with maps is available from Duchas. When phoning the local authority to arrange the meeting, the survey team should ask if this section has been completed and if the information is available. If not, then prior to meeting with the local authority the survey team should obtain the location of the treatment plant or scheme catchment and check the relevant up-to-date Duchas maps to determine if it falls within a SPA, SAC or NHA. If it does, take the site Nr. from the map and check the Site Synopsis report for that particular site on the Duchas Website (Address). This is usually only a page or two and will identify any aspects for consideration. This can then be filled in to the questionnaire during the meeting with the local authority. These sources of information should be recorded in the questionnaire and should be sufficient to satisfy the project brief with regard to “available” information. The local authority should be asked to check this information and confirm location.

SECTION C – SEWERAGE NETWORK

1.0 Catchment and Development Data

1.1 This question seeks a general description of both the catchment and the network. The catchment could be described under a number of different headings, e.g. location, population, topography, geology, local rivers, soil types, landmarks, history, prominent local industries. This information can typically be obtained from a town development plan.

A general description of the network should also be provided. This could typically include the average elevation, average slope, history of the sewerage system; the type, age and density of housing and other developments in the catchment; an indication of all major natural features in the catchment – to include forestry, water bodies and sites of specific interest; an indication of all major man-made features – to include main roads, rail lines, other pipelines and underground workings.

1.2 A plan of the catchment (similar to sample map 1) is required illustrating the existing drainage catchment and the development, including key geographic features e.g. water bodies and forestry.

1.3 A plan of the catchment (similar to sample map 2) is required illustrating the existing development area and land use by sector (Agriculture, Domestic, Institutional, Industrial, Holiday/Leisure, Commercial and undefined/mixed use) for the catchment. It is important to indicate the planning horizon year for the development area.

1.4 A plan of the catchment (similar to sample map 3) is required illustrating the future land use within the development area by specific sectors, similar to the sectors shown in map 2, ie. Agriculture, Domestic, Institutional, Industrial, Holiday/Leisure, Commercial and undefined/mixed use.

1.5 A copy of the most recent County Development Plan is required and should be provided by the Local Authority. If a Catchment Development Plan is available, then this should also be provided.

1.6 The area of the catchment served by public sewers should be indicated in hectares (ha). This area should include all private schemes, e.g. housing estates, which connect directly into the public sewerage network.

1.7 The area of the catchment served by private sewers should be indicated in hectares (ha). This area is to include all development served by septic tanks, and/or independent treatments which do not contribute to the public sewerage system.

1.8 The total number of households located within the catchment is to be identified. Should this number not be known, a range should be provided – e.g. 3200 – 3500.

1.9 The total number of households located within the catchment which are connected to the public sewer network is to be identified. Should this number not be known, a range should be provided – e.g. 2500 – 2700.

2.0 Population

2.1 The total resident winter population for the base data year (2002) is to be provided. An estimate of the 2002 population has been provided by the NUWWS Study in the introductory letter. This figure is based on the 1996 Census figures which has been projected to 2002 by applying regional growth figures developed by the Central Statistics Office (CSO). If the local authority estimate is significantly different (ie.+/- 10%) from the figures stated in the introductory cover letter then the local authority is requested to explain and substantiate the reasons why.

2.2 The approximate peak population for the base data year (2002) is to be provided. This may vary considerably from the total resident winter population in areas where holiday and leisure activities are predominant.

2.3 The estimated peak population for the project planning horizon (2022) is to be provided. It is important to indicate how this estimation has been calculated. Any significant variation in the projected growth rate from recent and historical rates or change should be explained.

3.0 Asset Inventory and Network Integrity

3.1 A plan of the drainage network (similar to sample map 4) is to be provided. This plan is to include all trunk sewers only – it is not necessary to provide details of minor sewers on this plan – and all major ancillaries including pumping stations, combined storm overflows, inverted siphons, storm attenuation tanks and Treatment Works.

3.2 A plan of the drainage network (similar to sample map 4) illustrating the predominance of the network type in specific areas – separate, combined or partially combined areas - is to be provided.

3.3 Pipe gradient and diameters of the sewers entering the treatment works should be marked a plan similar to map 4. These details are required to establish the existing capacity of the sewer network to carry sewerage to the treatment works.

3.4 A plan of the network (similar to sample map 5) illustrating locations of flooding – due to either an extreme hydrological event or a network problem – locations of blockages, and watercourse pollution due to failure of the network system is to be provided.

3.5 The total number of permanent flow monitors (if any) located on the public network is to be provided, and the locations shown on the plan.

3.6 The total number of permanent rain gauges (if any) located within the catchment is to be provided and shown on the plan.

3.7 The total number of permanent water quality loggers (if any) located on the public network is to be provided and shown on the plan.

3.8 The Local Authority is to indicate whether or not a database has been compiled for the network. If such a database has been compiled please indicate what format it has been prepared in – e.g. SUS 2000 / Excel File. A copy of this database is requested.

3.9 The Local Authority is to indicate if a computer model has been compiled for the network. If such a model is available, please indicate what format it has been prepared in – e.g. Hydroworks, Hec-Ras, Mapdrain, Isis. A copy of this model is requested.

3.10 For separate foul gravity sewers table 3.10 should completed in as full detail as possible. The total length of pipework is to be indicated within each band in metres, ie, less than or equal to 225mm diameter, greater than 225 and less than 600mm diameter, and greater than 600mm. A data reliability rating should be given to each line to identify the source of the information, based on the criteria outlined in Table 1.1 of this methodology.

The subsequent percentage of concrete pipelines is to be indicated. If the pipe material is not concrete, the material should be specified, where possible. The sum of the entries indicating the breakdown of each band of pipes by material should - total 100%.

The condition grade of each pipeline is to be completed as per the grading system outlined in Tables 1.2 and 1. of this methodology. Pipe grade ratings will be summarised as grade 3 and better, grade 4 or grade 5. The cumulative percentages of the 1-3, 4 and 5 percentage grades should be 100%.

The total number of foul sewer gravity manholes is required.

3.11 Data similar to that described in 3.10 is required for the storm sewer network.

3.12 Data similar to that described in 3.10 is required for combined storm/foul sewers.

3.13 Similar data requirement to 3.10-3.12 for sewer rising mains.

3.14 Details of the sewers prior to discharge into the Waste Water Treatment Plant is required. These sewers should be shown on a plan (similar to example map 4). Details of these sewers is requested to enable an assessment to be made of the maximum flows the sewerage network can discharge into the WWTP if the network is fully charged.

3.15 The largest diameter sewer in the drainage network is requested.

3.16 This table is to be completed if there are Combined Storm Overflows (CSO's) located on the network. The location of the CSO is to be to an Irish National Grid Reference. If there is a method of screening employed at the CSO, this method is to be indicated. The condition of both the Civil, M&E works (where appropriate) and the performance of the CSO are to be completed as per the condition grading system in Table 1.4 of this methodology. The name of the receiving water is to be indicated, if there is more than one recognised name for this receiving water then all names are to be supplied. The EPA Quality Rating (Biotic Index) for the receiving water is to be supplied. It is to indicated whether the receiving water is and inland waterway (river, stream or lake) or coastal waters.

3.17 This table is to be completed if there has been watercourse pollution due to the network in the recent past (10 yrs). The location of all flooding is to be identified, this information may be supplied either by supplying the street location or indicating the area on a map (similar to example map 5). The frequency, source and extent of pollution are also to be indicated.

3.18 This table is to be completed only if there are pumping stations located within the network. The location of the pumping station may be given as either the address or as a grid reference. The locations of the pumping stations should also be indicated on Map 4. The operating capacity of the pumping station is to be supplied in litres per second. The presence or absence of an emergency overflow is to be noted. The structural and M&E condition of the pumping station is to be graded in accordance with Table 1.4.

3.19 This table is to be completed if there are other major ancillaries located within the network such as storm attenuation tanks or inverted siphons. The location of the each ancillary may be given as either the address or as a grid reference. The locations of any ancillaries should also be indicated on Map 4. The operating capacity of the ancillary is to be supplied in litres per second where appropriate. The structural and M&E condition of each ancillary is to be graded in accordance with Table 1.4.

4.0 Operational Control & Staffing Structure

4.1 A complete staffing structure of the management team overseeing the operation and maintenance of the network is to be supplied. This information is to be supplied as a percentage of time per category of staff including engineers, technicians, caretakers and administrators. An organogram is also to be supplied. It should be noted that manpower inputs are requested.

4.2 The operational control of the network is to be supplied. This is to include all personnel working on control of the network and all M&E devises used in the control of the network including remote monitoring systems and SCADA systems employed.

5 Existing Surveys

5.1 Details of all existing surveys relating to the network are to be supplied. If CCTV coverage of the network has been intermittent and/or incomplete, individual surveys are to be recorded separately. The relevant year the survey was conducted is to be supplied. The length of sewer surveyed is to be indicated in metres, where appropriate.

The presence or absence of recognised quality control checks are to be noted, if quality control checks were carried out, was the quality acceptable? The Local Authority is to indicate if the output of the survey and map of the extent of the surveys/location of monitoring points is available. The number of monitors employed is to be supplied, where appropriate.

The Local Authority is to indicate if the results and/or reports of the survey are available. It is not necessary to submit these results/reports at this stage.

6.0 Adequacy of Existing System

6.1 The Local Authority is to supply information on all extreme storm events within the catchment since 1990. The date of this event and the return period is to be supplied. If flooding occurred as a result of a storm event, the location and extent of this flooding should be indicated on a drawing similar to sample map 5.

6.2 Details of all flooding due to problems within the network are to be supplied. These details are to include the location of the flooding and the frequency with which this flooding is causing problems, the type of sewer system – separate, combined or partially combined, the extent of flooding – localised, number of streets, etc., and whether the flooding has been verified by an hydraulic model. Again the locations of the flooding problems should be illustrated on a map similar to sample Map 5.

6.3 Details of all known structural failures of sewers are to be submitted, including the location, the cause of failure, the sewer type and the extent of failure.

6.4 Details of all other major failures on the network including the network ancillaries are to be documented. These may include failure of Civil or M&E works on storm attenuation tanks and inverted siphons.

6.5 The Local Authority is to submit details of all capital schemes invested on the sewerage network in the recent past (since 1990). These details are to include the type of project undertaken – network upgrading, new treatment works, etc., the location of the works undertaken, when the works were carried out and the value of works undertaken. Similar details are required for current and proposed capital schemes.

6.6 The Local Authority is to submit details of general maintenance problems associated with the network, including problems associated with siltation, grease, poor connections, sewer blockages, relining of manholes pumping capacities at pumping stations. These details are to refer to maintenance work carried out in the recent past (since 1995), currently ongoing and planned for the near future (2005).

7.0 Potential Solutions

7.1 The Local Authority is provided with the opportunity to submit details of potential solutions to the individual problems associated with the characteristics of their own network.

References

1 "Upward-Flow Tanks", Primary Sedimentation Manual of British Practice in Water Pollution Control published by the Institute of Water Pollution and Control, 1980, pages 65 – 68

2 "Horizontal Flow Tanks", Primary Sedimentation Manual of British Practice in Water Pollution Control published by the Institute of Water Pollution and Control, 1980, pages 65 – 68

3 "Radial Flow Tanks", Primary Sedimentation Manual of British Practice in Water Pollution Control published by the Institute of Water Pollution and Control, 1980, pages 51 – 64

4 BS6297 – Code of Practice for the design and installation of small sewage treatment works and cesspools.

5 "Design of Facilities for the Biological treatment of Wastewater", Wastewater Engineering, Treatment, Reuse and Disposal by Metcalf & Eddy, pages 574 – 579

APPENDIX A

The following sample documents were included to illustrate the type and format of information required; Staffing Organogramme, Network & Treatment Plant layout Drawings

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

3. SEWERAGE NETWORK INVENTORY

TABLE OF CONTENTS

SYNOPSIS

Assessment of the existing sewerage networks and evaluation of future data collection and network upgrading requirements was based primarily on the information provided by the local authorities in the Sewerage Network Questionnaires. However, the Pilot phase of the Study identified significant gaps in data availability and reliability.

In order to provide an indication of the total sewerage assets in the study catchments and/or to predict additional work required to collect the data, a methodology was developed to check the data quality and make good any gaps or questionable figures.

The data from seven towns, which had previously been subject to detailed investigation, was used to derive average sewer length and diameters and manhole densities. Data from five of these catchments was used to determine indicative overall length of sewer in structural condition grades 4 and 5. The derived values were found to compare favourably with similar data for Scotland England and Wales.

The approach to sewer structural performance grading and rehabilitation was based on the UK Sewerage Rehabilitation Manual. This aims to ensure that the core sewer network is not subject to failure, unsound sewers being identified early enough to take pre-emptive action, whilst occasional failure of minor, non-critical sewers can be tolerated on economic grounds.

The indicative relationships given below were established for checking and estimating purposes. The numerical values used for estimates, where Questionnaire data sets were found deficient, are given in the table.

Length of sewers versus properties served.

Breakdown of total sewers length per catchment by size range.

Distance between manholes.

Percentage length of core sewer in structural condition grades 4 & 5.

Sewerage Network Asset Density & Condition

Description	Units	Relationship
Length of Foul & Combined Sewer	Length in m where properties < 5000 Length in m where properties $\geq$ 5000	Properties served x 17 Properties served x 13
Length of sewer by Diameter	Length in m for 150 ≤ 225 dia. Length in m for 225<ϕ<600 dia. Length in m for sewers ≥ 600 dia.	Total length sewers x 81% Total length sewers x 16% Total length sewers x 3%
Number of manholes	Total no. manholes.	Total sewer length/50
Sewer Condition	m of core area sewer in CG 4/5	2% x total sewer length.

1.0 SEWERAGE DENSITY

1.1 INTRODUCTION

The Project Brief defines the requirement of the NUWWS with respect to asset recording. Section 2.2 states ' All of the key asset features of the sewerage system are to be recorded, including network length, trunk and interceptor sewers and major storm drains', whilst Section 2.8 states'…the consultants will be required to determine what, if any, additional work is required to collect sufficient useful data in future by the local authority.'

A Sewerage Network Questionnaire was prepared to facilitate the collection of data from each of the local authorities to allow for the assessment and evaluation of the schemes.

The questionnaire was the primary source of data. However, the pilot phase of the NUWWS identified significant gaps in data availability for the sewerage networks. In many cases records were limited or of doubtful reliability; in a number of cases there appeared to be no records. The questionnaire returns varied from an estimate of the total length of sewers to a detailed breakdown of lengths, sizes and condition.

In order to provide an indication of the total sewerage assets in the study towns and/or to predict additional work required to collect the data, a methodology was developed to check the data obtained from questionnaires and rectify gaps in it.

The objective was to estimate the probable number of manholes, the probable sewer length by pipe diameter and the indicative structural condition of the sewers. Relationships were developed for estimating the following parameters, based on available data and on the knowledge and experience of the consultants:

- Length of sewers versus catchment population or sewered area.
- Breakdown of total sewers length per catchment by size range.
- Distance between manholes on a sewer line.
- Percentage length of sewer in structural Condition Grades 4 & 5.

1.2 EXISTING DATA

In the past, sewerage network management has tended to be reactive, and there has been little demand for detailed records of the network. This is changing with the recent investments in the waste water sector. Preliminary Report investigations often include a manhole survey, CCTV survey, flow and rainfall investigations and the development of a verified model for the core area sewers. However surveys have generally been limited to combined and separate waste water sewers, ie. storm sewers have been excluded.

Data sources available to the consultants comprised SUS2000, drainage maps, CCTV Survey Reports and Preliminary Reports. Records for Ballyshannon, Gorey, Mullingar, Ennis, Carrigaline, Cobh and Dungarvan were used to assess sewerage density and structural condition.

The level of detail available from these seven catchments varied from survey of the core area sewers, ie. approximately 40% of the network, to almost full network surveys of the smaller catchments, with approximately 90% of the network covered.

The quality and source of the data guided the development of an appropriate method of assessment.

1.3 ASSET DENSITY

The area of the catchment served by the sewerage network was identified from maps. The number of properties in each catchment was identified either from the An Post Geodirectory, or a combination of a desk study map review and a physical property survey count. The number of existing manholes in each catchment was counted from maps of the sewerage network.

Pipe work was categorized by diameter into three classes, A, B & C, as defined in Table.1.1 below. These bands are the same as those used in the sewerage network questionnaire, with the exception of Class A, which in this sub-study does not include pipe lengths smaller than 150mm. However as these sizes appear to be limited to house connections, the tabulated sizes effectively cover the whole combined and foul network, excluding individual house connections.

Table 1.1
Pipe Size Classification

Class	Diameter Range (mm)
A	$150 \leq \phi \leq 225$
B	$225 < \phi < 600$
C	≥ 600

Pipe work lengths in each catchment were extracted from SUS2000 models of the study towns. Where the SUS2000 model was out of date or incomplete, additional pipe work lengths were scaled from drainage maps of the catchment.

Pipe work density was calculated by dividing the length of each class of pipe work by the number of properties and the area of the catchment. The units for pipe work density are therefore metres of pipe work per property or per hectare.

Table.1.2 below tabulates the data extracted from the available records and the relevant relationships applied to evaluate average asset densities.

The sewerage network records for each of the seven towns differed substantially for a number of reasons, in consequence of which, average values also varied widely. Key factors were:

- A large number of pipe diameters were unknown, particularly in Mullingar, Cobh and Ennis, but not Ballyshannon or Gorey.
- Incomplete survey records (i.e. only details of part of the network available).
- Differentiation between combined and separate networks or parts of networks needed clarification.

To adjust the data for the factors identified above, the corrections were applied in Tables 1.3 and 1.4 as described below.

i) In the smaller towns (Properties < 5000, namely Ballshannon, Gorey, Carrigaline, Cobh and Dungarvan), it was assumed that unknown pipe sizes are of Class A type. This was based on the assumption that larger pipes tend to be in the core area, which would have been investigated in detail to validate the network model. In towns with properties of 5000+ (namely Mullingar and Ennis) it was assumed that 80% of the unknown pipe work was Class A, while the remaining 20% was assumed to be Class B. See Table.1.3

Maps were reviewed in detail and an estimate was made of the % of the network, which the data source represented. The estimated percentage of network coverage is given in Table 1.3 below. The % excluded from the data source was assumed to have pipes and manholes of a similar density to the surveyed areas. An added criterion was that these pipe sizes would be Class A, as these areas were outside the core area (not identified as critical sewers) and therefore predominantly minor sewers. See Table 1.4.

ii) An attempt was made to establish the percentage breakdown of the catchment network between a combined and separate system. However, this could not be accurately identified from the source information and therefore the estimate of density of storm pipe work was not established.

It was therefore assumed that the SUS2000 models data represents foul and combined data only. If storm only sewers were included in the models then this is likely to be only for class B and C pipes and from experience likely to be not more than 10% of the total length.

Table 1.2
Manhole/Sewer Density Analysis

Catchment	No. of Properties (no.)	Total Sewer Length Class A (m)	Class B (m)	Class C (m)	Unknown (m)	Total (m)	Sewer Length per Property (m/prop)	No. of Manholes (no.)	Total Drainage Catchment Area (ha)	Sewer Length/Hectare (m/ha)	Manholes Per Hectare (MH/ha)	Sewer Length Per Manhole (m/MH)
Mullingar	6,303	31,990	13,780	5,108	10,661	61,539	9.76	1,311	560	110	2.34	46.94
Ennis	7,399	12,589	9,932	1,996	6,990	31,507	4.26	583	607	52	0.96	54.04
Ballyshannon	890	10,494	1,422	33	136	12,085	13.58	319	74	163	4.31	37.88
Gorey	1,320	11,476	2,163	1,122	1,314	16,075	12.81	388	285	56	1.36	41.43
Carrigaline	2,079	3,367	7,095	1,552	1,880	13,895	6.68	335	160	87	2.09	41.48
Cobh	2,794	12,865	7,641	565	14,378	35,449	12.69	516	176	201	2.93	68.70
Dungarvan	2,438	12,349	8,034	984	3,033	24,399	10.01	693	159	153	4.36	35.21

Table 1.3
Manhole/Sewer Density Analysis - Distribution of Unknown Pipe Diameters

Catchment	Network Coverage	No. of Properties	Total Sewer Length				Sewer Length per Property	No. of Manholes	Total Drainage Catchment Area	Sewer Length/Hectare	Manholes Per Hectare	Sewer Length Per Manhole
			Class A[2]	Class B	Class C	Total						
	(%)	(no.)	(m)	(m)	(m)	(m)	(m/prop)		(ha)	(m/ha)	(MH/ha)	(m/MH)
Mullingar	70	6,303	40,519	15,912	5,108	61,539	9.76	1,311	560	110	2.34	46.94
Ennis	39	7,399	18,181	11,330	1,996	31,507	4.26	583	607	52	0.96	54.04
Ballyshannon	89	890	10,630	1,422	33	12,085	13.58	319	74	163	4.31	37.88
Gorey	74	1,320	12,790	2,163	1,122	16,075	12.81	388	285	56	1.36	41.43
Carrigaline	47	2,079	5,247	7,095	1,552	13,895	6.68	335	160	87	2.09	41.48
Cobh	87	2,794	27,243	7,641	565	35,449	12.69	516	176	201	2.93	68.70
Dungarvan	50	2,438	15,382	8,034	984	24,399	10.01	693	159	153	4.36	35.21

([1] For smaller towns (Properties <5000), it is assumed that unknown pipes are of the Class A type and therefore this figure has been adjusted for each catchment. For larger towns (Properties >5000) it is assumed that 80% of the unknown pipes are Class A and 20% are Class B).

Table 1.4
Manhole/Sewer Density Analysis - Expansion to Full Catchment Area

Catchment	Network Coverage	No. of Properties	Total Sewer Length				Sewer Length per Property	No. of Manholes	Total Drainage Catchment Area	Sewer Length/Hectare	Manholes Per Hectare	Sewer Length Per Manhole
			Class A[2]	Class B	Class C	Total						
	(%)	(no.)	(m)	(m)	(m)	(m)	(m/prop)		(ha)	(m/ha)	(MH/ha)	(m/MH)
Mullingar	100	6,303	66,893	15,912	5,108	87,913	13.95	1,873	560	157	3.34	46.94
Ennis	100	7,399	67,461	11,330	1,996	80,787	10.92	1495	607	133	2.46	54.04
Ballyshannon	100	890	12,124	1,422	33	13,579	15.26	358	74	183	4.84	37.88
Gorey	100	1,320	18,438	2,163	1,122	21,723	16.46	524	285	76	1.84	41.43
Carrigaline	100	2,079	20,916	7,095	1,552	29,564	14.22	713	160	185	4.45	41.48
Cobh	100	2,794	32,540	7,641	565	40,746	14.58	593	176	232	3.37	68.70
Dungarvan	100	2,438	39,782	8,034	984	48,799	20.02	1386	159	307	8.72	35.21

[2] The percentage area not covered by each catchment model is assumed to have a pipe density similar to that of the areas surveyed and modeled. Since the unsurveyed areas are outside the core area it is also assumed that these pipes would be of the ≤225 type and therefore this figure has been adjusted for each catchment.
[3] The percentage area not covered by each catchment model is assumed to have a manhole density similar to that of the areas surveyed. This figure has therefore been adjusted accordingly for each catchment.

A summary of the final sewer and manhole densities is listed in Table 1.5. Review of this data shows that pipe densities per property of in the range of 10-20m/property, and pipe length per manhole are in the range 35-69m/MH.

The wide ranges of values is reflective of the assumptions made and the variation in catchment topography, housing density, development land use, amount of open space, and type of development such as ribbon versus denser in-fill. In conclusion Table 1.5 is considered to be reflective of the range of the typical sewerage network asset densities in Ireland.

Table 1.5
Adjusted Sewerage Asset Densities

Catchment	Sewer Length Per Property (m/prop)	Sewer Length Per Manhole (m/MH)
Mullingar	13.9	46.9
Ennis	10.9	54.0
Ballyshannon	15.3	37.9
Gorey	16.5	41.4
Carrigaline	14.2	41.5
Cobh	14.6	68.7
Dungarvan	20.0	35.2
1000-4999 Properties - Average	16.1	44.9
5000+ Properties – Average	12.4	50.5

The comparative range of values for England and Wales is 12 to 15m/property with an average of 14m/property based on the Ofwat Report.

The pipework statistical data can be further summarised in terms of the three primary pipe diameter ranges. This is shown in Table 1.6, and provides a generic source for estimating the proportion of diameters where only the total sewer length is known.

Table 1.6
Sewer Length by Pipe Diameter Range

Catchment	Class A	Class B	Class C
	(m)	(m)	(m)
Mullingar	76%	18%	6%
Ennis	84%	14%	2%
Ballyshannon	89%	10%	0-1%
Gorey	85%	10%	5%
Carrigaline	71%	24%	5%
Cobh	80%	19%	1%
Dungarvan	82%	16%	2%
Average	**81%**	**16%**	**3%**

2.0 SEWER STRUCTURAL CONDITION

2.1 CONDITION ASSESSMENT

Sewer survey and structural condition assessment in Ireland generally follows the approach described in the WRc Sewerage Rehabilitation Manual[1]. Closed Circuit Television (CCTV) inspections provide high quality pictures of sewers and allow for visual assessment of the internal condition grade (ICG) of sewer lengths. For large diameter sewers, man entry techniques are used. The structural performance or Condition Grade (CG) is then determined by reference to external environmental factors, which may increase the risk of collapse.

The Sewer Structural Condition Grades (CG) listed in Table 2.1 below are based on composite analysis of both the ICG and the environmental factors which affect the sewer, i.e. surrounding soil type, potential for ground movement and superimposed traffic loading.

Table 2.1
Sewer Condition Grades

Grade	Implication
5	Collapsed or collapse imminent
4	Collapse likely in foreseeable future
3	Collapse unlikely in near future but further deterioration likely
2	Minimal collapse risk in short term but potential for further deterioration
1	Acceptable structural condition

2.2 REHABILITATION PHILOSOPHY

Rehabilitation of structurally or hydraulically defective sewers will inevitably be more costly in the case of deeply buried, large diameter town centre sewers than for small diameter, shallow suburban sewers. In recognition of these factors and on the basis of extensive technical and financial analysis, the Sewerage Rehabilitation Manual (SRM) approach aims to ensure that the performance of key sewers is, ideally, maintained in perpetuity whilst occasional failure of minor sewers can be tolerated. Key terms referred to in the SRM are, *Core Area* and *Critical Sewers.*

The critical sewers are those with the most significant consequences in the event of structural failure; consequences being defined in terms of both the direct repair cost and the indirect social costs, such as those resulting from local loss of business, re-routing traffic, impact on provision of emergency services etc. For planning purposes, the SRM sub divides the sewer network into Category A, where failure is likely to be particularly expensive, Category B, less critical sewers where financial considerations make pre-emptive action desirable and Category C which are non-critical sewers.

Core area sewers comprise that part of the sewer network containing the critical sewers, and other sewers where hydraulic and pollution problems are likely to be most severe, requiring definition within a flow simulation model, and also the sewers which link sewers of the above types.

[1] Sewerage Rehabilitation Manual, 4th Ed'n Water Research Centre, June 2002

2.3 ANALYSIS OF DATA

The objective of the analysis was to assess the typical percentage of total sewer length in CG 4 and CG5 and, ideally the length currently requiring urgent rehabilitation, i.e. the CG 4 & 5 critical sewers. This percentage could then be used to check figures provided by the local authority or assess the likely percentage in CG4 or CG5 where no data is given.

In the analysis of the CCTV reports for selected catchments, the condition grading of the sewers is based entirely on the internal condition grading (ICG) of the sewer, and therefore ICG and CG are in this case synonymous. The following assumptions were made:

- It is assumed that ICG 4 & 5 require pro-active rehabilitation in the short-term.
- If a sewer length is less than 30m long, and contains at least one defect of ICG 4 or ICG 5, then it is assumed that the entire sewer length will be rehabilitated.
- If the sewer length is greater than 30m long then it is assumed that 6m of sewer length will be rehabilitated per individual ICG 4 or ICG 5 along the sewer length.

Table 2.2 below is a summary of the analysis of the CCTV condition surveys and the CG assessment of five towns for which data was analysed.

Table 2.2
Sewer Condition Summary

Town	Total Length(1) (m)	Surveyed Length(2) (m)	Total Repair Length (3) (m)	Repair length as % surveyed (%)	Repair Length as % of total (%)
Ennis	80,787	20,075	1,960	9.8	2.4
Ballyshannon	13,579	11,605	1,136	9.8	8.4
Gorey	21,723	4,571	357	7.8	1.6
Carrigaline	29,564	2,879	111	3.9	0.4
Cobh	40,746	4,826	366	7.6	0.9
Totals	*186,399*	*43,956*	*3,930*		
Average	*37,280*	*8,791*	*786*	*8.9*	*2.1(4)*

(1) Total sewer length from Table 4 in Section 1.
(2) Surveyed length is assumed comprise the core area sewers (primarily the critical sewers and interconnecting sewers) in all towns except Ballyshannon where 85% of all sewers were surveyed.
(3) The repair length is assumed to represent sewers in CG 4 and 5.
(4) The impact of the more extensive condition survey data for Ballyshannon is that this data causes some distortion. Excluding Ballyshannon the average repair length drops to 8.6% of the length surveyed and 1.6% of the total length.

Based on the above, and allowing for the apparent distortion introduced by the Ballyshannon data, it is suggested that overall approximately 2% of the total sewer length or 9-10% of the core area sewers will be in CG 4 or 5 and in need of urgent attention.

These figures are broadly consistent with data from the UK. The length of critical sewers in England and Wales is approximately 23% of the total. This compared well with the figures in Table 2.2 where the average length surveyed was approximately 22% of the total and this was assumed to represent the core area sewers. Similarly, the length of unsound sewers in UK[1&2] has been found to be in the range 0.5% to 2.1% of the total length compared to 2.1% above.

3.0 DATA REVIEW & PREDICTION

There are three primary applications of this predictive approach:

Assess the validity of completed questionnaire survey data.
Predict likely asset density and condition where data was not available.
Make projection of future asset densities.

Which method of application is most appropriate, i.e. by property or catchment area, depend on the quantity and quality of the data obtained during the questionnaire phase of the study. Some examples of the potential application of the methodology are given below.

3.1 QUESTIONNAIRE DATA CHECKS

The questionnaire survey data was checked by reference to the figures in Table 3.1 below. Where the data in the questionnaire did not fall within the representative band then further investigation was considered. If no satisfactory explanation was found or if the data was not provided in the questionnaires, representative values were determined from the figures in Table 3.2.

Table 3.1
Checklist for Sewerage Network Questionnaire Data

Check	Calculation	Expected Range
Population**	Population/3.0 = No. Properties	+/- 10% questionnaire.
Property Number**	Property Number = Population/3.0	+/- 10% questionnaire
Sewer Length**	Total Length/Properties = m/prop	14-20m/property - 1000-4999 prop. * 10-15m/property - 5000+ prop
Sewer Length**	Length/Catchment Area = m/ha	100-300m per hectare
Manholes	Manholes/Length of sewer = MH/m	1 manhole every 35-70m sewer.
Sewer Condition	% Sewer CG4/5	1-10% of total length
Pipe Diameter %	150 ≤ 225 sewers/total length = 225<φ< 600 sewers/total length= ≥ 600 sewers/total length=	70-90% 5-25% 0-6%

* Higher figures reflect that smaller Irish towns tend to display ribbon type development.
** Apply appropriate check.

3.2 DATA PROJECTION APPLICATION

Where the data obtained from the questionnaire survey is clearly incorrect or absent, then the steps summarised in Table.3.2 should be followed to fill the data gaps.

Table 3.2
Sewerage Network Asset Density Projection

Description	Units	Relationship
Length of Foul & Combined Sewer	Length in m where properties < 5000 Length in m where properties ≥ 5000	Properties served x 17 Properties served x 13
Length of sewer by Diameter	Length in m for 150 ≤ 225 dia. Length in m for 225<ϕ<600 dia. Length in m for sewers ≥ 600 dia.	Total length sewers x 81% Total length sewers x 16% Total length sewers x 3%
Number of manholes	Total no. Manholes.	Total sewer length/50
Sewer Condition	m of core area sewer in CG 4/5	2% x total sewer length.

* Separate, partial and combined foul sewer.

3.3 NETWORK EXPANSION PROJECTIONS

The steps summarised in Table 3.2 could also be applied to estimate the projected expansion of a sewerage network against a given population growth.

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DEPARTMENT OF THE ENVIRONMENT, HERITAGE AND LOCAL GOVERNMENT

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

4. FLOW & LOAD ASSESSMENT

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Doc. Nr. A7090-N-R-106

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SYNOPSIS

The method of assessing waste water flow and load was designed to provide a set of nationally comparable figures for the base year 2002 and the target year, 2022. A standardised approach was developed to estimate the hydraulic and pollutional loads by sector, taking due cognisance of available local information. The assessments were not intended to supersede or take the place of more detailed analysis required for the purpose of a feasibility study or Preliminary Report but rather to assist the Department of the Environment, Heritage and Local Government (DEHLG) in identifying and prioritising future investment needs.

General Approach

Measured and/or estimated flow and load data was initially obtained from the Engineering and Planning Departments of the relevant Local Authority (LA), by means of Questionnaire, which are described in elsewhere in this report.

Flow and load estimates were derived using the standard methodology and reasons were sought for any significant differences between the standardised estimates and LA data. Where necessary, a judgement was made as to the most appropriate figures to be used in the subsequent analysis. Both the LA data and the standard estimates for the year 2002 (and 2022) were tabulated in the catchment reports, which are included as Appendices. Table 1.1 illustrates the breakdown of the current and future flows and loads on a sectoral basis; the sectors being as shown in Table 1.2.

The first three lines of Table 1.1 list the resident and day visitor numbers. The estimated flows contributed by each of the sectors is given in the succeding lines along with the total dry weather flow – for this purpose, the flow contributed by visitors is summarised under the heading, Leisure/Tourist flow. The estimated load contributed by each of the sectors is given in the following six lines along with the total load from the direct catchment, which is converted to a population equivalent on the basis of 60 g/hd/d of BOD. The last two lines list any imported waste load and the total load to be treated in kg/d BOD. Numerical data from the LA for the year 2002 is given first with estimated figures for the years 2002 and 2022, based on the standard methodology, in the following two columns. The comments column details the basis of the standard estimates.

Standard Estimates

The waste water flow and load from the domestic sector was calculated from the residential population and the per capita contribution. Populations for both 2002 and 2022 were estimated on the basis of the 1996 census data and the Central Statistics Office (CSO) population projection scenarios.

The individual catchment studies were carried out in mid 2002, immediately following the April 2002 census. However the detailed census data was not available till the third quarter of 2003 by which time the analysis of catchments had been completed and draft reports issued. A comparison of the actual 2002 census figures and the population estimates used for analysis purpose was carried out on completion of the study. In a very small number of cases where significant differences were noted, the analysis was revisited and the actual 2002 census figures used.

The National Water Study (NWS) developed methodologies to estimate demand from both the domestic and non domestic sectors. The NWS per capita domestic consumption figures were used as appropriate in this study. However, as the non-domestic figures were less soundly based and the water supply boundaries did not correlate well with the waste water catchments, they were not used.

Commercial and institutional contributions were allowed for in the standard methodology where they were likely to contribute significant flows over and above the resident domestic contribution.

Industrial contributions were derived from LA returns as to flow and load or on the basis of zoned industrial land area and standard flow rates for different types of industry.

Leisure/Tourism activities tend to be seasonal and concentrated in specific localities. In many cases, the relevant details were not readily available from the LAs and a simple set of rules to estimate flow and load for resident and non-resident visitors were applied.

Infiltration and/or land drainage inflows to the sewerage system can form a significant part of the total flow to treatment. A simple set of rules, based on recent research data, were used to quantify likely infiltration and/or inflows to the network in the absence of sound local data.

Table 1.2
Description of Waste Water Contributing Sectors

Sector	Description of population (which contributes to the public sewerage system).
Domestic	Population permanently resident within the catchment, outside the tourist season.
Leisure/tourism	Seasonal residential and day visitors, a proportion of whom will contribute to the commercial sector via hotels etc
Institutional, inc. public services	Occupants of non-commercial premises who are not included in the above "domestic" population, e.g. occupants of educational establishments, hospitals or public service offices that originate from outside the catchment.
Commercial	Flows from commercial premises, whether measured or unmeasured, which have not been included under the 'domestic' or leisure/tourism headings plus flows from contributing activities, such as livestock markets within the urban area.
Industrial	All industrial waste water flows whether metered or not

Table 1.1
Estimated Flow and Load

Contributing Elements		LA Estimate or Measured	Standardised Estimated		Comment
			2002	2022	
Domestic Resident	nr				
Resident Visitors	nr				
Day Visitors	nr				
Per Capita Domestic Consumption	l/h/d				
Domestic Flow	m^3/d				
Leisure/Tourist Flow(1)	m^3/d				
Institutional Flow(2)	m^3/d				
Measured Commercial Flow(2)	m^3/d				
Unmeasured Commercial Flow(2)	m^3/d				
Industrial Flow	m^3/d				
Infiltration & Inflow(3)	m^3/d				
Imported Wastes	m^3/d				
Dry Weather Flow	m^3/d				
BOD Domestic load	kg/d				
BOD Leisure/Tourist(1)	kg/d				
BOD Institutional(2)	kg/d				
BOD Commercial(2)	kg/d				
BOD Industrial	kg/d				
Total	kg/d				
Population Equivalent	pe				
BOD Imported Waste	kg/d				
Total BOD Load	kg/d				

(1) Resident and Day Visitors combined
(2) Refers to contributions additional to those from the resident Domestic population
(3) Includes surface water from undeveloped land (land drainage)

For the purpose of assessing comparative treatment capacity and receiving waters assimilative capacity, the 2002 load was taken as the measured figure where reliable data was available. However, the standard estimates of flow and load for the years 2002 and 2022 as above were generally considered more representative of the proportional contributions by sector.

1.0 INTRODUCTION

1.1 THE OBJECTIVE

The objective of the flow and load assessment methodology is as follows:

- To establish hydraulic and pollutional loads by sector, including domestic, industrial and commercial, discharging to the treatment system in terms of dry weather flow, population equivalent etc.

- To established a realistic estimate of future demand for each scheme based on the most recent population trends, commercial developments, industrial development and planning targets.

Records of wastewater discharges were available from the authorities who make regular returns to the Environmental Protection Agency (EPA) with regard to pollutional loads and treatment works in their locality. However, audits carried out by the EPA identified deficiencies in some of the local authority (LA) waste water records and the initial field work, carried out as part of this study, indicated a very variable quality of data.

The approach set out below was designed to provide a set of nationally comparable figures for the base year 2002 and the target year, 2022. For this purpose, a standardised methodology was developed to estimate the hydraulic and pollutional loads by sector, taking due cognisance of available local information.

The results of these standardised assessments are not intended to superseded or take the place of more detailed analysis required for the purpose of a Preliminary Report but rather to assist the DEHLG in prioritising future investment and identifying issues which require further investigation.

1.2 DATA SOURCES

The primary sources of data used to establish the current flow and loads, the population and development trends/targets and future flow and loads were:

- Waste Water Treatment Plant Questionnaire returns from local authorities including flow, load and development data.

- Integrated Pollution Control (IPC) and/or Section 16 Licence data on Trade Effluents, as recorded in the above Questionnaire.

- Water Services Pricing Policy (polluter pays principle) data as recorded in the above Questionnaire.

- National Water Study by WS Atkins Ireland, March 2000, Volume 2.

- Census 96, Volume 1, Population Classified by Area, Central Statistics Office, Dublin, August 1997.

- Regional Population Projections, 2001 – 2031, Central Statistics Office, Dublin, June 2001.

- Environmental Protection Agency Report for the years 1998 and 1999, "Urban Waste Water Discharges in Ireland.

- CIRIA (Construction Industry Research and Information Asociation) Report 177, Dry Weather Flow in Sewers, 1998.

1.3 GENERAL APPROACH

Locally available information was initially obtained from the Engineering and Planning Departments of the relevant LA, by means of the Questionnaire described elsewhere in this report. National statistics were then sourced from the organisations/publications listed in 1.2 above,

To confirm the validity of the Questionnaire returns and ensure that all catchments were assessed on a broadly similar basis, flow and load estimates were prepared using the standard methodology. Reasons were sought for any significant differences between these estimates and LA data and where necessary, judgements made as to figures to be used in the subsequent analysis. Both the LA data and the standard estimates for the years 2002 and 2022 were tabulated as illustrated in Table 1.1 for clarity and the benefit of subsequent studies.

The first three lines of Table 1.1 list the resident and day visitor numbers. The estimated flows contributed by each of the sectors is given in the succeding lines along with the total dry weather flow – for this purpose, the flow contributed by visitors is summarised under the heading, Leisure/Tourist flow. The estimated load contributed by each of the sectors is given in the following six lines along with the total load from the direct catchment, which is converted to a population equivalent on the basis of 60 g/hd/d of BOD. The last two lines list any imported waste load and the total load to be treated in kg/d BOD. Numerical data from the LA for the year 2002 is given first with estimated figures for the years 2002 and 2022, based on the standard methodology, in the following two columns. The comments column details the basis of the standard estimates.

In general, the standard methodology was used in the assessment of the catchment population equivalent (pe) and also receiving waters assimilative capacity. However, where LA figures differed significantly but were supported by sound local and regional data, they were used in preference to the standardised estimates.

1.4 CONTRIBUTING SECTORS

For the purpose of this study, the sectors were as shown in Table 1.2 below.
Non-domestic discharges are licensed in one of two ways; by means of an Integrated Pollution Control (IPC) license issued by the Environmental Protection Agency (EPA) or by a Section 16 License issued by the LA, under the Local Government (Water Pollution) Act 1997. The EPA has sole responsibility for issuing and enforcing all IPC licences whilst the LAs are responsible for the licensing and control of activities that do not come within the scope of IPC licensing.

The LAs were requested in the Questionnaire, to provide all relevant parameters for the companies and their effluents, which have been licensed via IPC or Section 16 Licenses to discharge either directly to the Wastewater Treatment Plant (WWTP) or to the sewerage network.

Where a Water Service Pricing Policy Framework report was available, the contributing companies were checked against those listed in accordance with the above licensing procedure.

Table 1.1
Estimated Flow and Load

Contributing Elements		LA Estimate or Measured	Standardised Estimated		Comment
			2002	2022	
Domestic Resident	nr	-			
Resident Visitors	nr				
Day Visitors	nr				
Per Capita Domestic Consumption	l/h/d				
Domestic Flow	m^3/d				
Leisure/Tourist Flow(1)	m^3/d				
Institutional Flow(2)	m^3/d				
Measured Commercial Flow(2)	m^3/d				
Unmeasured Commercial Flow(2)	m^3/d				
Industrial Flow	m^3/d				
Infiltration & Inflow(3)	m^3/d				
Imported Wastes	m^3/d				
Dry Weather Flow	m^3/d				
BOD Domestic load	kg/d				
BOD Leisure/Tourist(1)	kg/d				
BOD Institutional(2)	kg/d				
BOD Commercial(2)	kg/d				
BOD Industrial	kg/d				
Total	kg/d				
Population Equivalent	pe				
BOD Imported Waste	kg/d				
Total BOD Load	kg/d				

(1) Resident and Day Visitors combined
(2) Refers to contributions additional to those from the resident domestic population
(3) Includes surface water from undeveloped land (land drainage)

For the purpose of assessing comparative treatment capacity and receiving waters assimilative capacity, the 2002 load was taken as the measured figure where reliable data was available. However, the standard estimates of flow and load for the years 2002 and 2022 as above were generally considered more representative of the proportional contributions by sector.

Table 1.2
Description of Waste Water Contributing Sectors

Sector	Description of population (which contributes to the public sewerage system).
Domestic	Population permanently resident within the catchment, outside the tourist season.
Leisure/tourism	Residential and day visitors, a proportion of whom will contribute to the commercial sector via hotels etc.
Institutional including Public Services	Occupants of non-commercial premises who are not included in the above "Domestic" population, e.g. occupants of educational establishments, hospitals or public service offices that originate from outside the catchment.
Commercial	Flows from commercial premises, whether measured or unmeasured, which have not been included under the "domestic" heading. These may include a proportion of the leisure/tourism component plus flows from agricultural activities, such as livestock markets within the urban area.
Industrial	All industrial waste water flows whether metered or not

1.5 NATIONAL WATER STUDY

The National Water Study (WS Atkins Ireland, 2000) developed methodologies to estimate demand from both the domestic and non-domestic sectors, as accurate water consumption figures were not widely available.

The per capita domestic consumption and the forecast demand growth rates correlated well with detailed data from the UK and were used as appropriate in this study. Non-domestic consumption figures were less soundly based than the domestic figures and the water supply boundaries did not correlate well with the waste water catchments, for which reason they were not used.

Waste water is managed on a more local basis than water supply thus local variations in the demand for services can have a significant impact on the system. Leisure/Tourism activities tend to be seasonal and concentrated in specific localities. In consequence, the contribution from this sector can have a very marked effect on the required treatment capacity and requires special consideration.

For comparative purposes, it may be noted that the National Water Study did not include sectoral estimates of demand under the heading, Leisure/Tourism but did make separate estimates for Agriculture. The agricultural component of the National Water Study relates primarily to supplies for farms etc outside the urban area. As the NUWWS is only concerned with urban area, the NWS agricultural flow data was not considered relevant.

2.0 DOMESTIC SECTOR

2.1 GENERAL

The waste water flow and load from the domestic sector was calculated from the residential population and the per capita contribution. The standard methodology used to estimate current and future populations is detailed in Appendix A.

The individual catchment studies were carried out in mid 2002, immediately following the April 2002 census. However the detailed census data was not available till the third quarter of 2003 by which time the analysis of catchments had been completed and draft reports issued. A comparison of the actual 2002 census figures with the standard population estimates was then carried out and in the very small number of cases where significant differences were noted, the analysis was revisited and the actual 2002 census figures used.

2.2 POPULATION VERIFICATION

Questionnaire population figures for 2002 and 2022 were compared with the figures projected from the 1996 Census as listed in the Appendix Table A2. Where variations of more than 10% occurred between the figures provided by the LA and the census projections, a more detailed assessment of the specific catchment was undertaken. Where the variation was less than or equal to ±10% the census projections were used in subsequent calculations.

Reasons for significant differences in figures were:

- The designation of a catchment as hub or gateway town under the National Spatial Strategy combined with reasonable indications of accelerating employment prospects and associated population growth over and above that predicted by the CSO data.
- The catchment area covered more than one (District Electoral Division) DED or did not coincide with the DED areas, and therefore the Census based projection needed to be revised to reflect the DED (and/or parts of DED) included in the catchment.
- Expansion or retraction of major sources of employment, such as the opening and closing of industry and commerce, which distorted the population trend.
- Proximity of the catchment to major centre of economic activity/employment (i.e. commuter areas) caused a local bias in growth figures.

Planning/land use policy can have significant impacts on population concentrations (e.g. development of a satellite town, re-zoning agricultural land to residential, institutional, commercial, etc). However, the existence of areas zoned for residential development were not of themselves considered an assurance that growth would take place, within the time horizon considered; matching employment opportunities being an essential part of the equation.

Where the LA population figures did not appear to be adequately supported, both sets of data were recorded and the above census-based estimates were used in subsequent analysis. It is anticipated that these figures will be reviewed in detail as a precursor to any investment being made.

For a small number of catchments or agglomerations (around 12 out of 182), the populations were not readily derived from census figures for 1996 and the 2002 estimates were dealt with on a one off basis, in conjunction with the local authorities.

Where appropriate, the derived population figures were checked for consistency with the land zoned for residential development by reference to the proposed future occupancy rate and dwelling density.

In the absence of specific housing densities being provided by the LA for the residential zones, the following housing densities (based on the government publication 'Residential Density – Guidelines for Planning Authorities) was assumed:

- Low density (in specified areas only) = 10 dwellings per hectare
- Medium density (outer suburban sites) = 35 dwellings per hectare
- High density (town/city centre sites) = 65 dwellings per hectare

Future occupancy rates per household were adopted from the National Water Study and are reproduced as Table A4 in Appendix A.

If the LA zoned area was less than that needed to accommodate the projected population increase, even after making allowance for a higher dwelling density and/or an increase in the zoned area of up to 10%, apparent shortfalls in land area were reviewed with the LA in question and a judgement made as to reasonable future (2022) population projections.

2.3 PER CAPITA FLOW RATES

The National Water Study provides a detailed assessment of domestic water consumption rates for both rural and town/urban areas of each County in Ireland. The national average figures for county/county boroughs range from 130 to 139 l/h/d in the Water Study base year of 1997, to between 146 and 158 l/h/d in the forecast year 2018. Interpolation of these figures to the Waste Water Study time scale gives a range of 134 to 144 l/h/d in the base year of 2002 and 152 to 159 l/h/d in the forecast 2022 (see Appendix Table A5). Interpolated consumption figures for the aggregate town areas of each county are given in Table A6 of the Appendix for the years 2002 and 2022.

It is recognised that not all water consumed will recur as a waste water flow in consequence of activities such as car washing and garden watering. However, such losses are considered to be small, around 5% according to CIRIA Report 177 of 1998. In light of the potentially much greater and more uncertain increase in flow from infiltration, discussed in Section 8, such losses were ignored and the total water consumption figures were used in the assessment of flow to treatment.

2.4 DOMESTIC POLLUTION LOAD

The "population equivalent" (pe) or unit of pollution load is the organic biodegradable load contributed per capita per day. One pe is defined as having a 5-day biochemical oxygen demand (BOD_5) of 60 g/capita/day.

The total pe was calculated on the basis of the maximum average weekly load entering the treatment plant during the year, excluding unusual situations such as those due to heavy rain. The other domestic pollution load parameters were determined on the following basis:

- S.S. load was calculated on the basis of 75 g/PE/day
- P load was calculated at average concentration of 10 mg/l
- Total N load was calculated at average concentration of 50 mg/l
- Total NH_3 value was calculated at average concentration of 25 mg/l

For the purpose of estimating the domestic pollution load, privately served populations are not considered significant; therefore, the population projections did not attempt to distinguish between those served by private and public systems.

3.0 LEISURE/TOURIST SECTOR

3.1 POPULATION & POPULATION BREAKDOWN

Not all catchments received a wastewater contribution from Leisure/Tourism activities. Allowance for current (2002) and future (2022) contributions in this sector were based on the information (total flow and load or visitor numbers) supplied by the LA.

Visitors were considered to contribute through the use of specific seasonal tourist facilities including informal accommodation in domestic properties, or through normal commercial services (public houses, hotels etc). Only those contributing via seasonal tourist facilities were considered under this heading.

Where towns were known to have seasonal leisure/tourist influx, and a range of figures was given by the LA, the lower figure was used for calculation purposes. Where the LA was unable to advise on the breakdown between resident and day visitors, a one third residential, two thirds day visitor split was assumed.

3.2 FLOW AND LOAD

The flows and loads for Residential and Day visitors were calculated on the following basis for both the current year, 2002 and planning horizon of 2022:

Description	Flow (l/h/d)	Load (g BOD/h/d)
Day Visitors	30	30
Residential Visitors*	80% of domestic	80% of domestic

*The flow for Residential visitors in rented accommodation may be higher. However, the difference is not considered significant for the purpose of this Study.

4.0 INSTITUTIONAL SECTOR

4.1 OVERALL

Where there were institutions (e.g. schools, universities, hospital, prison etc.) of significant size relative to the catchment population, the additional contribution were separately accounted for. A school whose catchment area was almost wholly within the drainage catchment under consideration was not considered to provide significant additional flow and load over and above that estimated for the resident domestic population and as such was ignored in the calculations. However, the waste water contribution from a hospital, or other institution whose population was likely to be drawn from an area rather greater than the immediate drainage catchment, was considered additional to the resident domestic flows and loads and the additional flow and load was allowed under this heading.

An approximation of the number or percentage of students from outside the catchment attending schools within the catchment was used in predicting the wastewater loads associated with schools, if the LA was unable to provide the information. The total flow and load was then adjusted to reflect that part of the flow and load, which could be attributed to persons from outside the catchment. The same procedure was followed for other institutions.

The flows and loads were calculated from the predicted occupancy using the following standard parameters (extracted from EPA Waste Water Treatment Manuals and moderated for the purpose of this study).

Source		Flow (l/h/d)	Load (g BOD/h/d)
Educational	Non-residential with cooking facilities	60	30
	Non-residential without canteen	40	20
	Boarding school		
	(I) residents	180	60
	(II) day staff(inc. mid-day meal)	60	30
Public Service	Offices with canteen	60	30
	Offices without canteen	30	20
Hospitals	Residential Homes	250	60
	Hospital, Medical	420	90
Prisons*		380	110

* It should be noted that facilities such as prisons might have their own treatment plant and therefore not contribute to the main WWTW.

Future institutional flows and loads were determined on a pro-rata basis with domestic population increases.

5.0 COMMERCIAL SECTOR

5.1 OVERALL

Existing and future commercial sector waste water flow and load was generally estimated using the relationship; commercial loading = 16% of domestic/residential loading. This relationship has been used extensively in the estimation of flow and load for design purposes and is widely accepted at a local and national level in Ireland.

Where the commercial sector was large relative to the size of the catchment and detailed information was available, the contribution was determined on the basis of the number of employees. Conversely small catchments with nominal commercial activity were considered to have a negligible commercial contribution and no specific allowance was made.

Local authority figures, which differed significantly from the above approach but were supported by sound local and regional data were used in preference to the standard methodology.

6.0 INDUSTRIAL SECTOR

6.1 CURRENT INDUSTRIAL FLOWS AND LOAD

Current industrial sector flows and loads were obtained from the Questionnaire returns. In the event that the LA could not supply the data or the information provided was deemed incomplete or otherwise inadequate, the following waste water flow figures were used:

- Light Industry = 14 m^3/ha/day
- Medium Industry = 28 m^3/ha/day
- Waste water load = domestic strength

6.2 FUTURE INDUSTRIAL FLOW AND LOAD

Future flows and loads were in the form of or derived from one of the following:

- LA estimates
- LA allocation to future industrial development x the flow rates given below
- Maximum consented flows and loads for existing industry
- Current figures increased in line with the projected populations

LA estimated future flows and loads were checked by comparison with the product of land allocation and the flow rates given below. Where the type of industry was not known, it was assume to be 'Light'.

Where the LA was unable to provide figures on either, future flow and load or development land, it was assumed that future flow and load would equal the maximum consented figures for the existing industries.

The following flow rates for different types of Industry were assumed.

- Light Industry = 14 m3/ha/day
- Medium Industry = 28 m3/ha/day

7.0 IMPORTED WASTES

7.1 IMPORTED LIQUORS

Imported liquors are site specific and were included at a BOD concentration quoted or estimated by the LA. If the plant under consideration formed part of a satellite station or a hub centre under a Sludge Management Plan these volumes were extracted from the Plan Report.

7.2 IMPORTED SLUDGES

Details of imported sludges were also obtained from the LA. In the event of the LA being unable to provide the relevant details with regard to solids content of imported or indigenous sludges, they were estimated as follows, and the sludge load for treatment calculated, provided an estimate of the corresponding volume of sludge was known:

- Unthickened waste activated sludge (WAS) to be taken at 0.75% dry solids
- Unthickened primary or humus sludges (PS) to be taken at 2% dry solids
- For (WAS) thickened in a Picket Fence Thickener to be taken at 4% dry solids
- For (WAS) thickened in a Gravity Belt Thickener to be taken at 6% dry solids
- For (PS) thickened in a Picket Fence Thickener to be taken at 6% dry solids
- For (PS) thickened in a Gravity Belt Thickener to be taken at 8% dry solids

In the event of the Local Authority being unable to provide the relevant parameter, the loadings for sludge liquors were calculated as follows, provided an estimate of the volume of imported sludge was known:

B.O.D	=	3,000 mg/l
S.S	=	300 mg/l
P	=	250 mg/l
NH3	=	400 mg/l

8.0 INFILTRATION

8.1 GENERAL

Infiltration to sewerage systems is determined by a wide range of factors from soil and groundwater characteristics to the length of the pipe network and the standards of construction. Infiltration is site specific and can only be assessed by long-term field measurement, which did not form part of this study.

The Questionnaire asked whether or not there was evidence of an infiltration problem. Such evidence commonly would take the form of continual high flow to the wastewater treatment plant during off-peak periods.

Detailed studies of infiltration (see CIRIA Report 177, Dry Weather Flows in Sewers, 1998) have shown a wide range of unit rates and values. Guidelines figures range from a volume per metre of sewer length to a percentage of the DWF. In a UK study, rates for existing sewers subject to infiltration ranged from 15% to 49% of the average DWF, or 19 to 102 l/capita/d; design figures also tend to be in this range.

Assessed infiltration and inflow (from land drainage) was therefore based on the following system characteristics:

- Predominantly new sewerage system (new town) on a steep catchment (>1:300) with relatively impermeable soils and without a high water table or reported infiltration problems = 30 l/capita/d

- Typical mature sewerage system, flatter catchment, not on impermeable soils & not reported as having high infiltration = 50 l/capita/d

- Predominantly older sewerage system in a flat catchment with permeable soils and/or a high water table and/or reported high infiltration = 100 l/capita/d

Figures over 100 l/capita/d were only used where extreme conditions had been quantified by flow measurement.

APPENDIX A

CATCHMENT POPULATION TRENDS

The Central Statistics Office (CSO) Report on the 1996 census (CSO, Volume 1, August 1997) records population data by the household and this is summarised by 'population and area of each Province, County, County Borough, Urban District, Rural District and District Electoral Division (DED)/Ward, in 1991 and 1996'. Table 7 of this Report provides a listing of 'persons in each town of 1,500 population and over, distinguishing those within legally defined boundaries and in suburbs or environs, in 1991 and 1996', and Table 12 provides an 'alphabetical list of Towns with their population, 1991 and 1996'.

The actual 2002 census data was used to check the projections towards the end of the study. In the very small number of cases where significant variance between the 2002 census and the projections derived from the 1996 census was noted, actual 2002 census data was used for analysis purpose.

Almost all the towns included as NUWWS named catchments, excluding those in Fingal and parts of Kildare, are listed in Table 7 of the above CSO report. However, the boundaries of drainage catchments do not necessarily coincide with DED/Ward boundaries so direct application of population and area figures to drainage catchments entail a varying degree of error.

Population and DED/Ward boundaries are available in electronic format. However, some significant manipulation and interpretation of the data would be required to derive populations within the specific drainage catchments. It was therefore concluded that an appropriate approach was to assign the census population summarised as town and suburbs to the named drainage catchments. These figures were extracted from Tables 6, 7 and 12 of the 1997 Census Report, and the 1991 and 1996 populations and percentage changes are given in the Appendix, Table A1.

The most recent detailed national statistical projection of population change, 'Population and Labour force Projections - 2001-2031' (CSO, July 1999) provides projections at five-year intervals. Assumptions used in the projections were agreed by an Expert Group from Government Departments, the CSO, educational institutions, and the Economic and Social Research Institute (ESRI).

The CSO projections were based on assumptions relating to future trends in fertility, mortality, migration and labour force participation. Three sets of assumptions were chosen for fertility (F1-F3), one for mortality and two for migration trends (M1-M2) up to the year 2031. For labour force projections, a single set of assumptions relating to future labour force participation rates was chosen.

For the purpose of the National Water Study, the CSO projection scenario M0F1 was used. However, recent work (CSO, August 2001) indicates that the M0F1 scenario is not reflective of current population changes with particular regard to immigration. In April 2000 net immigration was 20,000, and in April 2001 this figure was at a historical high of 26,300. The drive behind this increase has primarily been the success of the Irish economy, and it is anticipated that the figures will drop as GDP growth moderates.

A more recent population projection, (CSO, June 2001) indicate that a scenario known as M1F2 is more likely. Population projections to the years 2002 and 2022 are given in Appendix Table A2 for this scenario based on the assumptions set out below.

- Immigration continuing but diminishing +20,000 per annum in 1996/2001, +15,000 per annum in 2001/2006, +10,000 per annum in 2006/2011, +5,000 per annum in 2011/2031 (M1).
- Total fertility rate (TFR) to remain constant at its 1998 level to 2001, decrease to 1.75 by 2001 and remain constant thereafter (F2).
- The rate of change in population is stable in all counties – i.e. there is no sudden increase/decrease in any one county.
- The 1996 distribution of county population in the DEDs will apply throughout the forecast period.

The CSO provide growth projections from 2001-2031 on a regional basis and these are summarised in Table A3.1 for the 25-year period, 1996 to 2021. The projections vary from a 43.6% increase in Dublin, to a 2.4% drop in population in the Midlands. For the State as a whole, the increase is 22.3% or approximately 809,400 persons (0.81% per annum). However, it should be noted that 57% of that increase (461,200 persons) is in the Greater Dublin area.

Table A3.1
M1F2 Population Projections ('1000) from 1996 to 2021

Year	Border	Dublin	Mid-East	Midland	Mid-West	South-East	South-West	West	State
1996	407.3	1058.3	347.4	205.5	317.1	391.5	546.6	352.4	3626.1
2001	417.3	1163.2	380.1	208.0	331.0	402.4	563.0	368.9	3833.9
2006	426.1	1267.2	411.4	209.2	344.5	410.5	577.4	385.2	4031.4
2011	432.2	1364.2	439.3	208.4	356.2	414.1	587.7	399.6	4201.8
2016	435.1	1445.6	463.4	205.5	364.9	413.8	593.4	410.7	4332.4
2021	435.3	1519.5	485.0	200.5	370.6	410.3	594.8	419.5	4435.5
25 Year % Increase	6.9	43.6	39.6	-2.4	16.9	4.8	8.8	19.0	22.3

Growth projections are only available on a regional basis. Population projections were therefore compiled from the 1996 census data by applying regional rates of change, adjusted by interpolation to the NUWWS time frame, as in Table 2.1.2 below. The grouping of counties into regions is listed in Table2.1.3

Table A3.2
Projected Regional Populations ('000) & Rates of Change*

YEAR(S)	Border	Mid-East	Midland	Mid-West	South-East	South-West	West
1996 Pop'n	407.3	347.4	205.5	317.1	391.5	546.6	352.4
% 1996-2002	2.9%	11.2%	1.3%	5.2%	3.2%	3.5%	5.6%
2002 Pop'n	419.1	386.4	208.2	333.7	404.0	565.9	372.2
% 1996-2022	6.7%	40.7%	-3.1%	17.1%	4.5%	8.7%	19.4%
2022 Pop'n	434.7	488.7	199.1	371.2	409.0	594.2	420.6

* Rates of change interpolated to 2002 and 2022 from the CSO M1F2 projections.

Table A3.3
County Distribution by Region

Border	Mid-East	Midland	Mid-West	South-East	South-West	West
Cavan Donegal Leitrim Louth Monaghan Sligo	Kildare Meath Wicklow	Laois Longford Offaly West Meath	Clare Limerick Tipperary NR	Carlow Kilkenny Tipperary SR Waterford Wexford	Cork Kerry	Galway Mayo Roscommon

The individual Tables A3.1 to A3.3 are combined as Table A3.4, included at the end of this methodology.

The migration element and the regional/spatial constituency of this factor are singularly the most significant and the most uncertain factor. Largely dependent on immigration policy, the economic environment and the application and/or success of the proposed spatial strategy and decentralisation.

The 2000-2006 National Development Plan refers to the National Spatial Strategy (http://www.irishspatialstrategy.ie/population.shtml), which suggests that the 20 year projected population growth in Greater Dublin could be reduced from 80% to approximately 25% of the national growth if a National Spatial Strategy is successfully implemented.

Table A1
1991 and 1996 Census Population and Rates of Change for '91 – '96

Sch No.	Local Authority	Location	1991 Census	1996 Census	% Change
1	Carlow	Carlow+	14,207	14,979	5%
2		Muinebheag+	2,700	2,695	0%
3		Tullow+	2,424	2,364	-2%
4	Cavan	Bailieborough+	1,550	1,529	-1%
5		Belturbet	1,223	1,248	2%
6		Cavan+	5,254	5,623	7%
7		Cootehill+	1,791	1,822	2%
8		Kingscourt	1,260	1,190	-6%
9	Clare	Clarecastle ***(No CSO figures)***			
10		Ennis North+	16,058	17,726	10%
11		Ennis South ***(CSO figure incl above)***		included in above	
12		Ennistymon	917	920	0%
13		Kilkee	1,315	1,331	1%
14		Kilrush+	2,740	2,594	-5%
15		Lahinch	550	580	5%
16		Lisdoonvarna	842	890	6%
17		Newmarket-on-Fergus+	1,583	1,542	-3%
18		Shannon Town+	7,920	7,939	0%
19	Cork	Cork City* (County Borough)+C24	159,900	163,352	2%
20		Bantry+	2,777	2,936	6%
21		Clonakilty+	2,812	2,950	5%
22		Rosscarbery Owenahincha	455	406	-11%
23		Skibbereen+	1,892	1,926	2%
24		Charleville (or Rathluirc)+	2,646	2,667	1%
25		Fermoy+	4,462	4,469	0%
26		Kanturk+	1,777	1,666	-6%
27		Mallow+	7,611	7,768	2%
28		Mitchelstown+	3,090	3,123	1%
29		Ballincollig	12,562	13,760	10%
30		Bandon+	4,741	4,751	0%
31		Blarney/Tower	3,445	3,804	10%
32		Carrigaline+	6,482	7,827	21%
33		Carrigtwohill	1,212	1,232	2%
34		Cobh+	8,219	8,459	3%
35		Crosshaven	1,329	1,312	-1%
36		Glanmire **Riverstown**-Little Island	1,802	2,138	19%
37		Kinsale+	2,751	3,064	11%
38		Macroom+	2,363	2,574	9%
39		Midleton+	5,951	6,209	4%
40		Passage West+	3,606	3,922	9%
41		Tramore River Valley+	6,064	6,536	8%
42		Youghal+	5,828	5,943	2%
43	Donegal	Ardara	653	635	-3%
44		BallybofeyStranorlar+	2,972	3,047	3%
45		Ballyshannon+	2,838	2,775	-2%

Sch No.	Local Authority	Location	1991 Census	1996 Census	% Change
46		Buncrana+	4,388	4,805	10%
47		Bundoran+	1,438	1,796	25%
48		Carndonagh+	1,541	1,580	3%
49		Donegal Town+	2,193	2,296	5%
50		Dunfanaghy Portnablagh	280	290	4%
51		Dungloe	988	1,042	5%
52		Falcarragh	951	961	1%
53		Killybegs	1,522	1,408	-7%
54		Letterkenny+	10,726	11,996	12%
55		Milford	864	816	-6%
56		Moville	1,392	1,394	0%
57		Raphoe	1,090	1,065	-2%
58		Rathmullan	536	491	-8%
59	Galway	Galway City (County Borough)+	50,853	57,363	13%
60		Athenry+	1,612	1,614	0%
61		Ballinasloe+	5,892	5,723	-3%
62		Clifden	808	920	14%
63		Gort	1,093	1,182	8%
64		Loughrea+	3,271	3,335	2%
65		Portumna	1,017	984	-3%
66		Tuam+	5,540	5,627	2%
67	Kerry	Ballybunion	1,346	1,470	9%
68		Cahirciveen	1,213	1,250	3%
69		Castleisland+	2,207	2,233	1%
70		Dingle+	1,272	1,536	21%
71		Kenmare	1,366	1,420	4%
72		Killarney+	9,950	12,011	21%
73		Killorglin	1,229	1,278	4%
74		Listowel+	3,597	3,656	2%
75		Tralee+	17,862	19,950	12%
76	Kildare	Athy+	5,204	5,306	2%
77		Kildare Town+	4,196	4,278	2%
78		Leixlip+	13,194	13,451	2%
79		Osberstown ***(Towns listed below)***	32,839	39,726	21%
		Celbridge (Osberstown)	9,629	12,289	28%
		Naas (Osberstown)	11,141	14,074	26%
		Newbridge, Droichead Nua (Osberstown)	12,069	13,363	11%
80	Kilkenny	Callan	1,246	1,224	-2%
81		Graignamanagh Tinnahinch	1,395	1,374	-2%
82		Kilkenny City+	17,669	18,696	6%
83		Thomastown+	1,487	1,581	6%
84	Laois	Abbeyleix	1,299	1,259	-3%
85		Mountmellick+	3,003	2,912	-3%
86		Mountrath	1,375	1,298	-6%
87		Portarlington+	3,211	3,320	3%
88		Portlaoise+	8,360	9,474	13%
89		Stradbally	1,046	1,047	0%
90	Leitrim	Carrick on Shannon+	1,858	1,868	1%
91		Manorhamilton	995	1,008	1%
92	Limerick	Limerick City (County Borough)+	75,436	79,137	5%

Sch No.	Local Authority	Location	1991 Census	1996 Census	% Change
93		Ballykeeffe ***(No CSO figures)***			
94		Caherdavin ***(No CSO figures)***			
95		Castletroy ***(No CSO figures)***			
96		Kilmallock	1,311	1,231	-6%
97		Newcastle West+	3,612	3,618	0%
98		Rathkeale	1,803	1,546	-14%
99	Longford	Edgeworthstown (Meathas Truim)	801	737	-8%
100		Granard	1,221	1,173	-4%
101		Longford Town	6,824	6,984	2%
102	Louth	Ardee+	3,269	3,791	16%
103		Blackrock ***(No CSO figures)***			
104		Drogheda+	24,656	25,282	3%
105		Dundalk+	30,061	30,195	0%
106	Mayo	Achill	229	277	21%
107		Ballina+	8,167	8,762	7%
108		Ballinrobe	1,229	1,309	7%
109		Ballyhaunis	1,282	1,287	0%
110		Belmullet	986	954	-3%
111		Castlebar+	7,648	8,532	12%
112		Claremorris+	1,907	1,914	0%
113		Crossmolina	1,202	1,103	-8%
114		Kiltimagh	952	917	-4%
115		Knock	440	575	31%
116		Swinford	1,216	1,386	14%
117		Westport+	3,688	4,520	23%
118	Meath	Ashbourne+	4,411	4,999	13%
119		Athboy	1,083	1,172	8%
120		Duleek+	1,718	1,731	1%
121		Dunboyne+	2,392	3,080	29%
122		Dunshaughlin+	1,275	2,139	68%
123		Kells (Ceannanus Mor)+	3,539	3,542	0%
124		Laytown-Bettytown-Mornington+	3,360	3,678	9%
125		Mornington ***(CSO figure incl. Laytown)***		Included	
126		Navan (An Uaimh)+	11,706	12,810	9%
127		Slane	699	688	-2%
128		Trim+	4,185	4,405	5%
129	Monaghan	Ballybay+	1,156	1,152	0%
130		Carrickmacross+	3,341	3,617	8%
131		Castleblayney+	2,938	2,808	-4%
132		Clones+	2,347	2,170	-8%
133		Monaghan Town+	5,946	5,824	-2%
134	Offaly	Birr+	4,056	4,193	3%
135		Clara+	2,505	2,464	-2%
136		Edenderry+	3,742	3,825	2%
137		Tullamore+	9,430	10,039	6%
138	Roscommon	Ballaghaderreen	1,270	1,248	-2%
139		Boyle+	2,197	2,222	1%
140		Castlerea+	1,822	1,790	-2%
141		Monksland ***(No CSO figures)***			
142		Roscommon Town+	3,427	3,915	14%

Sch No.	Local Authority	Location	1991 Census	1996 Census	% Change
143	Sligo	Ballisadare	581	612	5%
144		Enniscrone ***(No CSO figures)***			
145		Sligo Town+	17,964	18,509	3%
146		Tubbercurry	1,069	1,089	2%
147	Tipperary N.R.	Ballina+	8,167	8,752	7%
148		Nenagh+	5,825	5,913	2%
149		Nenagh ***(CSO figure incl. above)***		Included	
150		Roscrea	4,231	4,170	-1%
151		Templemore+	2,325	2,244	-3%
152		Thurles+	6,955	6,939	0%
153	Tipperary S.R.	Cahir+	2,055	2,236	9%
154		Carrick-on-Suir+	5,143	5,217	1%
155		Cashel+	2,814	2,687	-5%
156		Clonmel+	15,562	16,182	4%
157		Fethard+	1,431	1,397	-2%
158		Tipperary Town+	4,963	4,854	-2%
159	Waterford	Dungarvan+	6,920	7,175	4%
160		Tramore+	6,064	6,536	8%
161		Viewmount area ***(No CSO figures)***			
162		Waterford City (County Borough)+	41,853	44,155	6%
163	Westmeath	Athlone+	15,358	15,544	1%
164		Kilbeggan	617	627	2%
165		Kinnegad	415	517	25%
166		Moate	1,529	1,452	-5%
167		Mullingar+	11,867	12,492	5%
168	Wexford	Courtown Riverchapel ***(No CSO figures)***			
169		Enniscorthy+	7,655	7,640	0%
170		Gorey+	3,840	3,939	3%
171		New Ross (Kilkeeny&Wexford)	6,079	6,147	1%
172		Rosslare Harbour (Ballygeary)	983	1,023	4%
173		Rosslare Strand	847	929	10%
174		Wexford Town+	15,393	15,862	3%
175	Wicklow	Arklow+	7,987	8,557	7%
176		Baltinglass	1,068	1,127	6%
177		Blessington	1,408	1,860	32%
178		Bray+	26,953	27,923	4%
179		Greystones+	10,778	11,296	5%
180		Kilcoole+	2,485	2,694	8%
181		Newtownmountkennedy+	2,321	2,528	9%
182		Wicklow+	6,215	7,290	17%
		TOTAL POPULATION	**1,106,032**	**1,170,118**	**6%**

+ indicates town plus environs/suburbs population.
* Cork City population in Census corrected for partial contributions from Ballincollig Riverstown, Balrney and Carrigtohill (to avoid double counting)
(corrections of 1991 - 12,124, 1802, 96 & 478 = -14500,
1996 - 13,288, 2183, 85 & 506 = 16,602)

Table A2

M1F2 CSO Regional Population Change Rates Projected from 1996 to 2002 & 2022

Sch No.	Local Authority	Location	1996 Census	M1F2 Change	2002 M1F2	M1F2 Change	2022 M1F2
1	Carlow	Carlow+	14,979	3.2%	15,458	4.5%	15,648
2		Muinebheag+	2,695	3.2%	2,781	4.5%	2,815
3		Tullow+	2,364	3.2%	2,440	4.5%	2,470
4	Cavan	Bailieborough+	1,529	2.9%	1,573	6.7%	1,632
5		Belturbet	1,248	2.9%	1,284	6.7%	1,332
6		Cavan+	5,623	2.9%	5,785	6.7%	6,001
7		Cootehill+	1,822	2.9%	1,875	6.7%	1,945
8		Kingscourt	1,190	2.9%	1,224	6.7%	1,270
9	Clare	Clarecastle ***(No CSO figures)***		5.2%	-	17.1%	-
10		Ennis North+	17,726	5.2%	18,612	17.1%	20,750
11		Ennis South ***(CSO figure incl above)***	included	5.2%		17.1%	
12		Ennistymon	920	5.2%	966	17.1%	1,077
13		Kilkee	1,331	5.2%	1,398	17.1%	1,558
14		Kilrush+	2,594	5.2%	2,724	17.1%	3,037
15		Lahinch	580	5.2%	609	17.1%	679
16		Lisdoonvarna	890	5.2%	935	17.1%	1,042
17		Newmarket-on-Fergus+	1,542	5.2%	1,619	17.1%	1,805
18		Shannon Town+	7,939	5.2%	8,336	17.1%	9,293
19	Cork	Cork City (County Borough)+	163,352	3.5%	169,114	8.7%	177,577
20		Bantry+	2,936	3.5%	3,040	8.7%	3,192
21		Clonakilty+	2,950	3.5%	3,054	8.7%	3,207
22		Rosscarbery Owenahincha	406	3.5%	420	8.7%	441
23		Skibbereen+	1,926	3.5%	1,994	8.7%	2,094
24		Charleville (or Rathluirc)+	2,667	3.5%	2,761	8.7%	2,899
25		Fermoy+	4,469	3.5%	4,627	8.7%	4,858
26		Kanturk+	1,666	3.5%	1,725	8.7%	1,811
27		Mallow+	7,768	3.5%	8,042	8.7%	8,444
28		Mitchelstown+	3,123	3.5%	3,233	8.7%	3,395
29		Ballincollig	13,760	3.5%	14,245	8.7%	14,958
30		Bandon+	4,751	3.5%	4,919	8.7%	5,165
31		Blarney/Tower	3,804	3.5%	3,938	8.7%	4,135
32		Carrigaline+	7,827	3.5%	8,103	8.7%	8,509
33		Carrigtwohill	1,232	3.5%	1,275	8.7%	1,339
34		Cobh+	8,459	3.5%	8,757	8.7%	9,196
35		Crosshaven	1,312	3.5%	1,358	8.7%	1,426
36		Glanmire **Riverstown**-Little Island.	2,138	3.5%	2,213	8.7%	2,324
37		Kinsale+	3,064	3.5%	3,172	8.7%	3,331
38		Macroom+	2,574	3.5%	2,665	8.7%	2,798
39		Midleton+	6,209	3.5%	6,428	8.7%	6,750
40		Passage West+	3,922	3.5%	4,060	8.7%	4,264
41		Tramore River Valley+	6,536	3.5%	6,767	8.7%	7,105
42		Youghal+	5,943	3.5%	6,153	8.7%	6,461
43	Donegal	Ardara	635	2.9%	653	6.7%	678

Sch No.	Local Authority	Location	1996 Census	M1F2 Change	2002 M1F2	M1F2 Change	2022 M1F2
44		BallybofeyStranorlar+	3,047	2.9%	3,135	6.7%	3,252
45		Ballyshannon+	2,775	2.9%	2,855	6.7%	2,962
46		Buncrana+	4,805	2.9%	4,944	6.7%	5,128
47		Bundoran+	1,796	2.9%	1,848	6.7%	1,917
48		Carndonagh+	1,580	2.9%	1,626	6.7%	1,686
49		Donegal Town+	2,296	2.9%	2,362	6.7%	2,450
50		Dunfanaghy Portnablagh	290	2.9%	298	6.7%	310
51		Dungloe	1,042	2.9%	1,072	6.7%	1,112
52		Falcarragh	961	2.9%	989	6.7%	1,026
53		Killybegs	1,408	2.9%	1,449	6.7%	1,503
54		Letterkenny+	11,996	2.9%	12,342	6.7%	12,803
55		Milford	816	2.9%	840	6.7%	871
56		Moville	1,394	2.9%	1,434	6.7%	1,488
57		Raphoe	1,065	2.9%	1,096	6.7%	1,137
58		Rathmullan	491	2.9%	505	6.7%	524
59	Galway	Galway City (County Borough)+	57,363	5.6%	60,579	19.4%	68,471
60		Athenry+	1,614	5.6%	1,705	19.4%	1,927
61		Ballinasloe+	5,723	5.6%	6,044	19.4%	6,831
62		Clifden	920	5.6%	972	19.4%	1,098
63		Gort	1,182	5.6%	1,248	19.4%	1,411
64		Loughrea+	3,335	5.6%	3,522	19.4%	3,981
65		Portumna	984	5.6%	1,039	19.4%	1,175
66		Tuam+	5,627	5.6%	5,943	19.4%	6,717
67	Kerry	Ballybunion	1,470	3.5%	1,522	8.7%	1,598
68		Cahirciveen	1,250	3.5%	1,294	8.7%	1,359
69		Castleisland+	2,233	3.5%	2,312	8.7%	2,427
70		Dingle+	1,536	3.5%	1,590	8.7%	1,670
71		Kenmare	1,420	3.5%	1,470	8.7%	1,544
72		Killarney+	12,011	3.5%	12,435	8.7%	13,057
73		Killorglin	1,278	3.5%	1,323	8.7%	1,389
74		Listowel+	3,656	3.5%	3,785	8.7%	3,974
75		Tralee+	19,950	3.5%	20,654	8.7%	21,687
76	Kildare	Athy+	5,306	11.2%	5,901	40.7%	7,464
77		Kildare Town+	4,278	11.2%	4,758	40.7%	6,018
78		Leixlip+	13,451	11.2%	14,959	40.7%	18,923
79		Osberstown ***(Towns listed below)***	39,726	11.2%	44,181	40.7%	55,886
		Celbridge (Osberstown)	12,289	11.2%	13,667	40.7%	17,288
		Naas (Osberstown)	14,074	11.2%	15,652	40.7%	19,799
		Newbridge, Droichead Nua (Osberstown)	13,363	11.2%	14,862	40.7%	18,799
80	Kilkenny	Callan	1,224	3.2%	1,263	4.5%	1,279
81		Graignamanagh Tinnahinch	1,374	3.2%	1,418	4.5%	1,435
82		Kilkenny City+	18,696	3.2%	19,294	4.5%	19,531
83		Thomastown+	1,581	3.2%	1,632	4.5%	1,652
84	Laois	Abbeyleix	1,259	1.3%	1,276	-3.1%	1,220
85		Mountmellick+	2,912	1.3%	2,951	-3.1%	2,822
86		Mountrath	1,298	1.3%	1,315	-3.1%	1,258
87		Portarlington+	3,320	1.3%	3,364	-3.1%	3,217
88		Portlaoise+	9,474	1.3%	9,600	-3.1%	9,180
89		Stradbally	1,047	1.3%	1,061	-3.1%	1,014
90	Leitrim	Carrick on Shannon+	1,868	2.9%	1,922	6.7%	1,994
91		Manorhamilton	1,008	2.9%	1,037	6.7%	1,076

Sch No.	Local Authority	Location	1996 Census	M1F2 Change	2002 M1F2	M1F2 Change	2022 M1F2
92	Limerick	Limerick City (County Borough)+	79,137	5.2%	83,280	17.1%	92,638
93		Ballykeeffe ***(No CSO figures)***		5.2%	-	17.1%	-
94		Caherdavin ***(No CSO figures)***		5.2%	-	17.1%	-
95		Castletroy ***(No CSO figures)***		5.2%	-	17.1%	-
96		Kilmallock	1,231	5.2%	1,295	17.1%	1,441
97		Newcastle West+	3,618	5.2%	3,807	17.1%	4,235
98		Rathkeale	1,546	5.2%	1,627	17.1%	1,810
99	Longford	Edgeworthstown (Meathas Truim)	737	1.3%	747	-3.1%	714
100		Granard	1,173	1.3%	1,189	-3.1%	1,137
101		Longford Town	6,984	1.3%	7,077	-3.1%	6,767
102	Louth	Ardee+	3,791	2.9%	3,900	6.7%	4,046
103		Blackrock ***(No CSO figures)***		2.9%	-	6.7%	-
104		Drogheda+	25,282	2.9%	26,012	6.7%	26,983
105		Dundalk+	30,195	2.9%	31,067	6.7%	32,226
106	Mayo	Achill	277	5.6%	293	19.4%	331
107		Ballina+	8,762	5.6%	9,253	19.4%	10,459
108		Ballinrobe	1,309	5.6%	1,382	19.4%	1,562
109		Ballyhaunis	1,287	5.6%	1,359	19.4%	1,536
110		Belmullet	954	5.6%	1,007	19.4%	1,139
111		Castlebar+	8,532	5.6%	9,010	19.4%	10,184
112		Claremorris+	1,914	5.6%	2,021	19.4%	2,285
113		Crossmolina	1,103	5.6%	1,165	19.4%	1,317
114		Kiltimagh	917	5.6%	968	19.4%	1,095
115		Knock	575	5.6%	607	19.4%	686
116		Swinford	1,386	5.6%	1,464	19.4%	1,654
117		Westport+	4,520	5.6%	4,773	19.4%	5,395
118	Meath	Ashbourne+	4,999	11.2%	5,560	40.7%	7,033
119		Athboy	1,172	11.2%	1,303	40.7%	1,649
120		Duleek+	1,731	11.2%	1,925	40.7%	2,435
121		Dunboyne+	3,080	11.2%	3,425	40.7%	4,333
122		Dunshaughlin+	2,139	11.2%	2,379	40.7%	3,009
123		Kells (Ceannanus Mor)+	3,542	11.2%	3,939	40.7%	4,983
124		Laytown-Bettytown-Mornington+	3,678	11.2%	4,090	40.7%	5,174
125		Mornington ***(CSO figure incl. Laytown)***		11.2%		40.7%	
126		Navan (An Uaimh)+	12,810	11.2%	14,247	40.7%	18,021
127		Slane	688	11.2%	765	40.7%	968
128		Trim+	4,405	11.2%	4,899	40.7%	6,197
129	Monaghan	Ballybay+	1,152	2.9%	1,185	6.7%	1,229
130		Carrickmacross+	3,617	2.9%	3,721	6.7%	3,860
131		Castleblayney+	2,808	2.9%	2,889	6.7%	2,997
132		Clones+	2,170	2.9%	2,233	6.7%	2,316
133		Monaghan Town+	5,824	2.9%	5,992	6.7%	6,216
134	Offaly	Birr+	4,193	1.3%	4,249	-3.1%	4,063
135		Clara+	2,464	1.3%	2,497	-3.1%	2,388
136		Edenderry+	3,825	1.3%	3,876	-3.1%	3,706
137		Tullamore+	10,039	1.3%	10,173	-3.1%	9,727
138	Roscommon	Ballaghaderreen	1,248	5.6%	1,318	19.4%	1,490
139		Boyle+	2,222	5.6%	2,347	19.4%	2,652
140		Castlerea+	1,790	5.6%	1,890	19.4%	2,137
141		Monksland ***(No CSO figures)***		5.6%	-	19.4%	-

Sch No.	Local Authority	Location	1996 Census	M1F2 Change	2002 M1F2	M1F2 Change	2022 M1F2
142		Roscommon Town+	3,915	5.6%	4,135	19.4%	4,673
143	Sligo	Ballisadare	612	2.9%	630	6.7%	653
144		Enniscrone ***(No CSO figures)***		2.9%	-	6.7%	-
145		Sligo Town+	18,509	2.9%	19,043	6.7%	19,754
146		Tubbercurry	1,089	2.9%	1,120	6.7%	1,162
147	Tipperary N.R.	Ballina+	8,752	5.2%	9,210	17.1%	10,245
148		Nenagh+	5,913	5.2%	6,223	17.1%	6,922
149		Nenagh ***(CSO figure incl. above)***	Included	5.2%		17.1%	
150		Roscrea	4,170	5.2%	4,388	17.1%	4,881
151		Templemore+	2,244	5.2%	2,361	17.1%	2,627
152		Thurles+	6,939	5.2%	7,302	17.1%	8,123
153	Tipperary S.R.	Cahir+	2,236	3.2%	2,308	4.5%	2,336
154		Carrick-on-Suir+	5,217	3.2%	5,384	4.5%	5,450
155		Cashel+	2,687	3.2%	2,773	4.5%	2,807
156		Clonmel+	16,182	3.2%	16,699	4.5%	16,905
157		Fethard+	1,397	3.2%	1,442	4.5%	1,459
158		Tipperary Town+	4,854	3.2%	5,009	4.5%	5,071
159	Waterford	Dungarvan+	7,175	3.2%	7,404	4.5%	7,495
160		Tramore+	6,536	3.2%	6,745	4.5%	6,828
161		Viewmount area ***(No CSO figures)***		3.2%	-	4.5%	-
162		Waterford City (County Borough)+	44,155	3.2%	45,567	4.5%	46,126
163	Westmeath	Athlone+	15,544	1.3%	15,751	-3.1%	15,061
164		Kilbeggan	627	1.3%	635	-3.1%	608
165		Kinnegad	517	1.3%	524	-3.1%	501
166		Moate	1,452	1.3%	1,471	-3.1%	1,407
167		Mullingar+	12,492	1.3%	12,659	-3.1%	12,104
168	Wexford	Courtown Riverchapel ***(No CSO figures)***		3.2%	-	4.5%	-
169		Enniscorthy+	7,640	3.2%	7,884	4.5%	7,981
170		Gorey+	3,939	3.2%	4,065	4.5%	4,115
171		New Ross (Kilkeeny&Wexford)	6,147	3.2%	6,344	4.5%	6,421
172		Rosslare Harbour (Ballygeary)	1,023	3.2%	1,056	4.5%	1,069
173		Rosslare Strand	929	3.2%	959	4.5%	970
174		Wexford Town+	15,862	3.2%	16,369	4.5%	16,570
175	Wicklow	Arklow+	8,557	11.2%	9,517	40.7%	12,038
176		Baltinglass	1,127	11.2%	1,253	40.7%	1,585
177		Blessington	1,860	11.2%	2,069	40.7%	2,617
178		Bray+	27,923	11.2%	31,054	40.7%	39,282
179		Greystones+	11,296	11.2%	12,563	40.7%	15,891
180		Kilcoole+	2,694	11.2%	2,996	40.7%	3,790
181		Newtownmountkennedy+	2,528	11.2%	2,812	40.7%	3,556
182		Wicklow+	7,290	11.2%	8,108	40.7%	10,256
		TOTAL POPULATION	**1,170,118**	**5.0%**	**1,228,720**	**14.7%**	**1,342,611**
		Annualised % Change		0.82%		0.53%	

NOTES:

+ indicates town plus environs/suburbs population.

% change is from 1996. Ie. 1996-2002, 1996-2022.

* Cork city population in census corrected for partial contributions from Ballincollig, Riverstown, Blarney and Carrigtohill (to avoid double counting)

(Corrections of 1991 – 12, 124, 1802, 96 & 478 = -14,500; 1996 – 13, 288, 2183, 85 & 506 = 16,602)

Table A3.4
M1F2 Regional Rates of Change Calculated for 2002 and 2022

YEAR(S)	Border	Dublin	Mid-East	Midland	Mid-West	South-East	South-West	West	State
1996	407.3	1058.3	347.4	205.5	317.1	391.5	546.6	352.4	3626.1
2001	417.3	1163.4	380.1	208.0	331.0	402.4	563.0	368.9	3834.1
2006	426.1	1267.2	411.4	209.2	344.5	410.5	577.4	385.2	4031.5
% 1996-2002	2.9%	11.9%	11.2%	1.3%	5.2%	3.2%	3.5%	5.6%	6.8%
2002	419.1	1184.2	386.4	208.2	333.7	404.0	565.9	372.2	3873.6
2021	435.3	1519.5	485.0	200.5	370.6	410.3	594.8	419.5	4435.5
2026	432.3	1586.8	503.6	193.6	373.6	403.7	591.8	425.2	4510.6
% 1996-2022	6.7%	44.9%	40.7%	-3.1%	17.1%	4.5%	8.7%	19.4%	22.7%
2022	434.7	1533.0	488.7	199.1	371.2	409.0	594.2	420.6	4450.5

Table A4
Future Occupancy Rates for Counties/County Boroughs & Aggregate Town Areas

County/County Borough	County/Co. Borough* 2018	Aggregate Town Area**	
		2018	*2022*
Carlow	2.87	2.73	*2.67*
Cavan	2.76	2.67	*2.61*
Clare	2.70	2.67	*2.61*
Cork County Borough	2.55	-	-
Cork County	2.81	2.76	*2.68*
Donegal	2.83	2.70	*2.64*
{Dublin County Borough}	2.30	n/a	*n/a*
{Dun Laoghaire-Rathdown}	2.60	n/a	*n/a*
{Fingal}	2.99	n/a	*n/a*
{South Dublin}	3.02	n/a	*n/a*
Galway County Borough	2.71	-	-
Galway County	2.86	2.61	*2.55*
Kerry	2.67	2.55	*2.49*
Kildare	2.93	2.89	*2.82*
Kilkenny	2.82	2.61	*2.55*
Laois	2.87	2.76	*2.69*
Letrim	2.54	2.41	*2.35*
Limerick County Borough	2.54	-	-
Limerick County	2.86	2.91	*2.84*
Longford	2.72	2.72	*2.66*
Louth	2.77	2.67	*2.61*
Mayo	2.73	2.56	*2.50*
Meath	2.95	2.84	*2.77*
Monaghan	2.86	2.59	*2.53*
Offaly	2.87	2.76	*2.69*
Roscommon	2.67	2.55	*2.49*
Sligo	2.66	2.54	*2.48*
Tipperary North	2.77	2.53	*2.47*
Tipperary South	2.73	2.58	*2.52*
Waterford County Borough	2.60	-	-
Waterford County	2.74	2.63	*2.57*
Westmeath	2.77	2.67	*2.60*
Wexford	2.83	2.62	*2.56*
Wicklow	2.79	2.74	*2.67*

* Extracted from National Water Study (RK2370/DG/712/014 Rev 4, Table 9)
** Derived from individual county report projections for Aggregate Town Areas

{not covered by the National Water Study}
Interpolated from the National Water Study, Table 8.1

Table A5
County and County Borough Per Capita Water Consumption

Extracted fron National Water Study (RK2370/DG/712/014 Rev 4, Table 11)

County/County Borough	Per Capita Consumption l/h/d			
	1997	*2002*	2018	*2022*
Carlow	132.5	*136.2*	148.1	*151.1*
Cavan	132.6	*136.6*	149.6	*152.8*
Clare	134.6	*138.8*	152.2	*155.6*
Cork County Borough	136.7	*141.0*	154.8	*158.2*
Cork County	133.2	*137.3*	150.4	*153.7*
Donegal	130.6	*134.5*	147.0	*150.1*
{Dublin County Borough}	139.4	*143.9*	158.1	*161.7*
{Dun Laoghaire-Rathdown}	134.8	*138.9*	152.2	*155.5*
{Fingal}	130.2	*134.1*	146.4	*149.5*
{South Dublin}	129.8	*133.7*	146.0	*149.1*
Galway County Borough	134.5	*138.3*	150.4	*153.4*
Galway County	131.4	*135.4*	148.2	*151.4*
Kerry	133.9	*138.0*	151.1	*154.4*
Kildare	131.9	*135.9*	148.7	*151.9*
Kilkenny	131.9	*135.9*	148.7	*151.9*
Laois	131.3	*135.3*	148.0	*151.2*
Letrim	135.7	*139.9*	153.3	*156.7*
Limerick County Borough	133.0	*137.0*	149.8	*153.0*
Limerick County	132.6	*136.7*	149.7	*153.0*
Longford	133.2	*137.3*	150.3	*153.6*
Louth	131.3	*135.3*	147.9	*151.1*
Mayo	131.9	*135.9*	148.5	*151.7*
Meath	131.7	*135.7*	148.4	*151.6*
Monaghan	130.3	*134.2*	146.6	*149.7*
Offaly	131.3	*135.3*	148.0	*151.2*
Roscommon	133.7	*137.8*	151.1	*154.4*
Sligo	134.0	*138.1*	151.2	*154.5*
Tipperary North	133.7	*137.8*	151.1	*154.4*
Tipperary South	134.3	*138.4*	151.7	*155.0*
Waterford County Borough	134.8	*138.9*	152.2	*155.5*
Waterford County	132.9	*136.9*	149.9	*153.1*
Westmeath	132.5	*136.5*	149.5	*152.7*
Wexford	133.0	*137.1*	150.1	*153.4*
Wicklow	132.3	*136.3*	149.2	*152.4*

{not covered by the National Water Study}
Interpolated from the National Water Study, County Reports, Table 8.1

Note: Per capita consumption figures given in the national Water Study for the year 2003 and were considered representative of the base year as they differ by less than 1% from the 2002 interpolated figures. Both 2002 and 2003 figures are tabulated above and the actual figures used in the flow and load estimates are given in Table 2.5 of the individual catchment reports (see Appendices to County Reports).

Table A6
Aggregate Town Area per Capita Water Consumption

Town Areas	Per Capita Consumption l/h/d		
	2002	2003	*2022*
Carlow	*138.5*	139.3	*155.0*
Cavan	*138.0*	138.8	*154.4*
Clare	*139.3*	140.1	*156.1*
Cork County	*138.0*	138.8	*154.5*
Donegal	*136.2*	137.0	*152.2*
Galway	*138.8*	139.6	*155.5*
Kerry	*139.8*	140.6	*156.5*
Kildare	*136.4*	137.2	*152.6*
Kilkenny	*138.8*	139.6	*155.5*
Laois	*136.7*	137.5	*152.8*
Leitrim	*142.0*	142.8	*159.3*
Limerick	*136.2*	137.0	*152.2*
Longford	*137.3*	138.1	*153.6*
Louth	*136.6*	137.4	*151.0*
Mayo	*138.1*	138.9	*154.5*
Meath	*137.0*	137.8	*153.3*
Monaghan	*137.7*	138.5	*154.0*
Offaly	*136.7*	137.5	*152.8*
Roscommon	*139.7*	140.5	*156.5*
Sligo	*139.9*	140.7	*156.7*
Tipperary_NR	*141.4*	142.3	*158.6*
Tipperary_SR	*140.6*	141.5	*157.7*
Waterford County	*138.5*	139.3	*155.0*
Westmeath	*137.9*	138.7	*154.5*
Wicklow	*136.9*	137.7	*153.1*
Wexford	*140.0*	140.8	*157.0*

Interpolated from the National Water Study

Note: Per capita consumption figures given in the national Water Study for the year 2003 were considered representative of the base year as they differ by less than 1% from the 2002 interpolated figures. Both 2002 and 2003 figures are tabulated above and the actual figures used in the flow and load estimates are given in Table 2.5 of the individual catchment reports (see Appendices to County Reports).

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

5. ASSIMILATIVE CAPACITY OF RECEIVING WATERS

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SYNOPSIS

The assimilative capacity of the receiving waters is a measure of its ability to absorb waste water discharges whilst complying with relevant legislation and water quality objectives.

For rivers this was calculated using the 95 percentile river flow rate, maximum permissible concentrations for key parameters, the target water quality based on compliance with the relevant legislation (listed below) and current water quality data. In cases where the water quality upstream of a catchment was poorer than the downstream target quality this was acknowledged, and the assimilative capacity in terms of some parameters (generally phosphorus) was considered to be limited. An improvement in upstream water quality was recommended in these cases.

Since flow data was generally not available for lakes, estuaries and coastal waters qualitative comments were made in terms of the current and possible future impact of waste water discharges on the receiving water quality. The results of previous modelling exercises and studies were referred to where they were provided.

For the purpose of this study the parameters which were considered include BOD_5, ammonia, nitrate, phosphate, suspended solids and faecal coliforms. The maximum permissible concentrations for these were taken as the lowest concentrations specified by the applicable relevant legislation set out below.

- Bathing Waters Directive (76/160/EEC)
- Urban Waste Water Treatment Regulations 2001
- Surface Water Directive (75/440/EEC)
- Freshwater Fish Directive (78/659/EEC)
- European Communities (Quality of Salmonid Waters) Regulations (1988)
- European Communities (Quality of Bathing Waters) Regulations (1988 – 1998)
- Local Government (Water Pollution) Act, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998
- Shellfish Directive (79/923/EEC)
- Quality of Shellfish Waters Regulations 1994
- European Communities (live Bivalve Molluscs) (Health Conditions for Production and Placing on the Market) Regulations, 1996
- Live Bivalve Molluscs (Production Areas) Designation, 2001 (No.1)

In addition to the above, a limit of 1 mg/l of an increase in the BOD_5 concentration in the receiving waters (outside the mixing zone) was also adopted for the purpose of this study, in accordance with Water Quality Guidelines memorandum No. 1, 1978.

Other concentration limits were set for some waters based on specific Water Quality Management Plans, Catchment Management Plans or Phosphorus Measures Implementation Reports, and these were also considered where details were provided. Compliance with the more onerous standards required for Blue Flag status for beaches and marinas was considered but recognised that it is not a legislative requirement but a local water quality issue.

Where traditional activities such as bathing, or fishing take place in waters which are not specifically designated in the applicable regulations, adherence to water quality standards specified therein was considered desirable but identified as a local water quality issue rather than a legislative requirement.
The assimilative capacity was then used to determine the level of treatment to be provided prior to discharge of effluent from a waste water treatment plant, or to determine the suitability of the receiving waters to accept effluent discharges.

1.0 ASSESSMENT OF RECEIVING WATERS

1.1 ASSIMLATIVE CAPACITY OF RECEIVING WATERS

The assimilative capacity of the receiving waters is a measure of its ability or suitability to absorb waste water discharges whilst complying with relevant legislation and water quality objectives.

For the purpose of this study the assimilative capacity was used to determine the level of waste water treatment to be provided prior to discharge and whether or not an alternative more suitable receiving water should be identified.

The parameters used for calculating the assimilative capacity were BOD, phosphate, ammonia, nitrate, and faecal coliforms. Where sufficient data was readily available the assimilative capacity in terms of BOD, nutrients and suspended solids was calculated. The available assimilative capacity in terms of nutrients was considered of greatest relevance for receiving waters that are designated as Sensitive Areas under the Urban Waste Water Treatment Regulations 2001, or where an improvement in water quality is required under the Water Quality Standards for Phosphorus Regulations, 1998.

The faecal coliform concentration was considered relevant primarily where shellfish production areas or bathing areas are located downstream of, or close to the outfall from the waste water treatment plant or sewerage network. In these cases, the assimilative capacity of the receiving waters in respect of faecal coliforms was calculated where relevant and where sufficient data was readily available.

The impact of discharges from the sewerage networks and waste water treatment plants on receiving water quality was determined (but not quantified) based on the changes in water quality between upstream and downstream monitoring points. If discharges other than the urban waste water discharge (e.g., from private or industrial treatment discharges) were known to occur it was acknowledged that these were also likely to be impacting on the quality of the receiving waters.

In the case of coastal waters, harbours or estuaries where water quality data was available for the water body as a whole and upstream and downstream monitoring locations were not identified, a general comment only was made on the possible impact of discharges from the urban drainage scheme.

In the following analyses the current conditions refer to the year 2002, while future conditions refer to the year 2022.

1.2 ASSIMALITIVE CAPACITY OF RIVERS

1.2.1 Formula and Parameters

To estimate the assimilative capacity of a freshwater river in terms of the relevant parameters the following formula was used:

Assimilative capacity in kg/day = $(C_{max} – C_{back})$ x F_{95} x 86.4

Where
C_{max} = maximum permissible concentration in the receiving water expressed in mg/l
C_{back} = background (upstream) concentration expressed in mg/l
F_{95} = 95 percentile flow expressed in m^3/s
86.4 = Numerical Constant

C_{max}

The maximum permissible concentration was based on the water quality required in the receiving waters for compliance with current legislation. Concentration limits have also been set for some waters based on specific Water Quality Management Plans, Catchment Management Plans, or Phosphorus Measures Implementation Reports, and these were also considered where adequate details were provided.

Where traditional activities such as bathing or fishing take place in waters which are not specifically designated for these activities in corresponding legislation, adherence to the associated water quality standards specified therein was considered desirable but identified as a local water quality issue rather than a legislative requirement.

C_{max} for Phosphate

The Local Government (Water Pollution) Act 1977, (Water Quality Standards for Phosphorus) Regulations, 1998 set minimum target water quality standards for rivers and lakes based on their Biological Water Quality or Q Rating assigned by the EPA as a result of monitoring carried out by the EPA during the period from 01/01/1995 to 31/12/1997. Where a Biological Water Quality or Q Rating was not assigned for that period, the target quality was based on the results of the next monitoring period after 1995 – 1997.

The base year data were obtained from the report “Water Quality in Ireland 1995 – 1997 published by the EPA. The target Biological Quality Ratings and phosphate median concentrations for rivers were obtained from the Third Schedule (Part I) of the above Regulations, a copy of which is included in Appendix A. For the purpose of this study, the phosphate median concentration was taken to represent the maximum concentration permissible for compliance with these regulations.

C_{max} for BOD

Target concentrations for BOD, nitrogen and other parameters are not set by these regulations. Maximum permissible concentrations for BOD were based on other regulations (where relevant or applicable) as listed in Table 1.1

Table 1.1
Recommended or Mandatory Limit Values for BOD

EU or National Regulations	Units	Guide Value	Mandatory Value
Surface Water Regulations (S.I. No. 294 of 1989)			
A1 Waters	mg/l	N/A	5
A2 Waters	mg/l	N/A	5
A3 Waters	mg/l	N/A	7
Freshwater Fish Directive (78/659/EEC)			
(Salmonid)	mg/l	≤ 3	-
(Cyprinid)	mg/l	≤ 6	-
Salmonid Waters Regulations (S.I. No. 293 of 1988)	mg/l	N/A	5

The maximum permissible concentration was taken as the lowest mandatory concentration specified by the applicable relevant legislation above.

In addition to the above, a maximum permissible increase of 1 mg/l in the BOD concentration in the receiving waters (outside the mixing zone) was adopted. This was based on Memorandum No. 1 Water Quality Guidelines prepared by the Technical Committee on Effluent and Water Quality Standards (1978).

C_{max} for Nitrogen

The maximum permissible concentrations for ammonium and nitrate nitrogen were taken as the lowest concentrations specified by the applicable and relevant legislation as set out in Table 1.2

Table 1.2
Recommended or Mandatory Limit Values for Ammonia and Nitrate

EU or National Regulations		Ammonia		Nitrate	
	Units	Guide Valve	Mandatory Value	Guide Value	Mandatory Value
Surface Water Regulations [S.I. No. 294 of 1989] A1 Waters A2 Waters A3 Waters	 mg/l mg/l mg/l	 N/A N/A N/A	 0.2 NH_4 1.5 NH_4 4.0 NH_4	 N/A N/A N/A	 50 NO_3 50 NO_3 50 NO_3
Freshwater Fish Directive [78/659/EEC] (Salmonid) (Cyprinid) (Salmonid) (Cyprinid)	 mg/l mg/l mg/l mg/l	 $\leq$ 0.005 NH_3* $\leq$ 0.005 NH_3* $\leq$ 0.04 NH_3** $\leq$ 0.20 NH_3**	 $\leq$0.025 NH_3* $\leq$0.025 NH_3* $\leq$ 1.0 NH_3** $\leq$ 1.0 NH_3**	 - -	 - -
Salmonid Waters Regulations (S.I. No. 293 of 1988)	mg/l mg/l	N/A N/A	$\leq$ 0.02 NH_3* $\leq$ 1.00 NH_3**	-	-
Drinking Water Directive [98/83/EC]	mg/l	N/A	0.5 NH_4	N/A	50 NO

* Limits are for Non-ionised Ammonia
** Limits are for Total Ammonia

C_{max} for Coliforms

In terms of faecal coliforms, where applicable, the maximum concentration was taken as the lowest value specified by the relevant legislation as set out in Table 1.3 below. It should be noted with regard to the Bathing Water Regulations, that the standards required for Blue Flag status for beaches and marinas are much more onerous, and that compliance with the more onerous standards was considered a local water quality issue rather than a legislative requirement.

Table 1.3
Recommended or Mandatory Limit Values for Faecal Coliforms

EU Directive or National Regulations	Units	Guide Value	Mandatory Value
Surface Water Regulations [S.I. No. 294 of 1989]			
A1 Waters	No/100ml	N/A	1,000
A2 Waters	No/100ml	N/A	5,000
A3 Waters	No/100ml	N/A	40,000
Bathing Water Regulations [1989 – 1998]	No/100ml No/100ml	N/A N/A	< 1,000 [1] < 2,000 [2]
Shellfish Directive [79/923/EEC]	No/100ml	$\leq$ 300 [3]	-

Notes

[1] To be conformed with by 80% or more of samples, and not to be exceeded by any two consecutive samples in any case.
[2] To be conformed with by 95% or more of samples, and not to be exceeded by any two consecutive samples in any case.
[3] Value applies "in the shellfish flesh and intervalvular liquid", but, pending the adoption of another Directive on the protection of the consumers of shellfish products, "it is essential that this value be observed in waters in which live shellfish directly edible by man".

C_{back}

The background (upstream) concentrations of the relevant parameters were obtained from the most up to date results of water quality monitoring undertaken by the EPA, and the various local authorities. It is understood that local fishery bodies also monitor river water quality, but their results were generally not readily available. EPA data was obtained from the report on "Water Quality in Ireland 1998 – 2000" published by the EPA. More recent data was available for some water bodies. While minimum, median and maximum concentrations were provided for BOD_5, total ammonia, oxidised nitrogen, and ortho-phosphate (plus other parameters), the median values were considered representative of current concentrations. Faecal colilform concentration is not routinely measured and was not readily accessible for most water bodies.

Where high background concentrations (e.g., in terms of nutrients or coliforms) was considered to be due to other sources or diffuse pollution (such as agricultural run-off) this was acknowledged. Such background or upstream pollution was found to have a limiting effect on the assimilative capacity of some receiving waters and this was noted.

F_{95}

The 95 percentile flow is defined as the flow which is equalled or exceeded 95 % of the time in the long term and is expressed in m^3/s. The 95 percentile flows, together with the grid reference for each of the measuring stations, were obtained from the EPA web site (www.epa.ie) under the Water Resources section. Where a measuring station was listed, but no flow data provided, the relevant data was obtained from the body responsible for the station, e.g., OPW or ESB, etc. Where no flow monitoring data was available for a river, its assimilative capacity could not be calculated.

Data used was based on the measurement station nearest to the scheme discharge. Allowances were made for the flows from any tributaries which may join the river between the measurement station and the point of waste water discharge into the river, when the flows in these tributaries was available.

Where 95 percentile flow data was not available, and dry weather flow data was provided, it was used not to calculate the actual assimilative capacity of the river but to indicate the order of magnitude of assimilative capacity available.

1.2.2 Result

The calculated assimilative capacity was compared with current and future waste water discharges to determine the adequacy or suitability of the receiving waters.

Where the assimilative capacity was calculated to be less than the current discharge in respect of any of the relevant constituents, it was considered that there was inadequate assimilative capacity available for current and future projected discharges and the limiting constituent was noted.

Where the difference between the calculated assimilative capacity and either the current or projected future discharge in respect of any of the relevant constituents was marginal, it was considered that the assimilative capacity was severely limited in respect of that particular constituent. In such cases, increases in the quantity of the discharge were considered undesirable.

Where the assimilative capacity was calculated to be less than the current discharge and no significant impact on water quality was recorded, it was considered that there was inadequate assimilative capacity available (for current and future projected discharges) but the current water quality status was noted.

Where the background concentrations were found to be already higher than the target or permissible concentrations (due to some other factor such as agricultural run-off from the surrounding area, or upstream discharges from other sources) this was noted. In such cases the assimilative capacity of the receiving water was reported to be severely limited, with an improvement in upstream water quality required.

In some of these cases the impact of the urban waste water discharge not be significant resulting in very small increases in concentration, and investment in greater levels of waste water treatment may not bring about any noticeable improvement in the quality of the receiving waters. This was noted and recorded that the need for investment in the wastewater treatment facility for this purpose is questionable.

In the absence of data on background concentrations of faecal coliforms in a river, and the very low natural decay rate of coliforms in freshwater rivers, the load discharged from the waste water treatment plant was expressed as the increase in faecal coliform concentration. There are very few (<10) freshwater rivers/lakes which are designated under the Bathing Water Regulations and which require compliance with the standards specified therein. There are also, numerous “traditional” bathing areas in use throughout the country. The approach that was adopted for the purpose of this study was that a river/lake was considered to be unsuitable for bathing if the wastewater discharge would increase the faecal coliform concentration by more than 2,000 FC/100 ml. Any investment for an improvement in water quality to achieve the water quality standards set by the Bathing Waters Regulations in this regard was considered as a local authority issue rather than a legislative requirement.

1.3 ASSIMILATIVE CAPACITY OF LAKES

To calculate the assimilative capacity of a lake and the impact of a discharge from an urban drainage scheme or waste water treatment plant it is necessary to know

- All of the inflows to the lake including rainfall, run-off from surrounding catchment, and inflow from rivers & streams
- All of the outflows including evaporation, river and stream flows and any water abstractions.

It is also essential to have a dispersion model prepared for the lake.

Where all of the above information was not available or provided it was not possible within the scope of this study to quantify the assimilative capacity of a lake in numerical terms. However, a general qualitative estimate of whether a lake has or has not got sufficient assimilative capacity for a waste water discharge was made based on

- the existing water quality,
- the target water quality, and
- an estimate of current and future discharges from the WWTP.

The size of the load being discharged in relation to the volume/size of the receiving waters was also taken into account.

The estimate of current waste water discharges was based on the flow and quality of effluent currently discharged from a waste water treatment plant, or on typical raw wastewater concentrations for discharges from sewerage networks not served by treatment facilities. Future discharges were estimated based on projected flows and treated effluent concentrations achievable with the existing treatment facilities or with the "planned" treatment facilities. The treated effluent concentrations used in the analysis were the typical standards that could be achieved by such facilities, rather than the current concentrations being achieved.

Information on the existing water quality in lakes was obtained either from the report "Water Quality in Ireland (1998 – 2000) published by the EPA, or from local authority monitoring programmes. The target water quality was obtained from the Third Schedule of the Local Government (Water Pollution) Act 1977, (Water Quality Standards for Phosphorus) Regulations, 1998.

In general if a lake was classified as either Eutrophic or Hypertrophic, its water quality was considered to be in need of improvement, with an increase in nutrient loading considered undesirable. In such cases the provision of nutrient removal facilities and/or tertiary treatment for waste water prior to discharge from an urban drainage scheme was considered desirable. In each case consideration was given to the scale of the discharge in terms of the volume of the lake, and the possible impact of improved effluent quality on the water quality in the lake.

For lakes, which were found to require an improvement in water quality for compliance with legislation, it was considered desirable that waste water discharges from the urban drainage scheme or waste water treatment plant should not be increased beyond current levels in terms of kg/day.

Where the water quality in a lake was found to be currently of an acceptable standard (not in need of improvement), it was considered to have sufficient assimilative capacity for current discharges and some additional waste water discharge. This could not be quantified in the absence of a dispersion model.

In addition to the foregoing, the Urban Waste Water Treatment Regulations 2001 designated seven lakes as sensitive waters. These regulations require “more stringent treatment than secondary treatment or an equivalent treatment in respect of all discharges from agglomerations with a population equivalent of more than 10,000 into sensitive areas or the relevant catchment areas of sensitive areas where the discharges contribute to the pollution of these areas”.

For the purpose of this study, in such cases the provision of nutrient removal facilities prior to waste water discharge was considered necessary for compliance with legislation.

Where an improvement in water quality was found to be necessary to facilitate traditional amenities and activities rather than legislative designations, any associated investments to achieve the associated water quality standards were considered to be local authority requirements rather than legislative requirements.

Where insufficient hydraulic information was available the preparation of a dispersion model was identified as an investment requirement for the scheme.

1.4 ASSIMALITIVE CAPACITY OF ESTUARIES AND COASTAL WATERS

Difficulties associated with the estimation of the assimilative capacities of estuaries and coastal waters are similar to those for lakes. However, tidal flows and current patterns also have an impact.

Unless a previous study had been undertaken, or the receiving waters modelled hydraulically, the impact of discharges from the urban drainage scheme or waste water treatment plant could not be quantified numerically or predicted accurately. Qualitative assessments were made in such cases where sufficient information was available.

Similarly future compliance with current legislative requirements for Bathing Waters, Salmonid Waters, Shellfish Waters and Shellfish Production Areas could not be accurately predicted.

In such cases it was considered necessary to recommend further detailed studies and/or dispersion modelling of the outfall discharge.

An estimate of the impact of current waste water discharges on the receiving waters was made on the basis of current water quality and the trophic status classification as reported in “Water Quality in Ireland 1998 – 2000 published by the EPA.

Where the receiving waters were reported to be in compliance with the current legislative requirements, sufficient assimilative capacity was considered to be available for current waste water discharges. Where an improved level of treatment was planned for such a catchment, and the future discharge was calculated to be less than the current load, then the receiving waters could also be assumed to have adequate assimilative capacity for future loads. However, this assumption could not be made in terms of coliforms unless disinfection was included in the planned treatment facilities. The impact of larger future discharges on the receiving water could not be determined in the absence of dispersion modelling. In this case, the investment requirement identified was for dispersion modelling initially, with possible future investment in effluent disinfection. The nature and scale of the waste water discharge in relation to the volume/size of the receiving waters was taken into account in making such qualitative assessments.

Where the receiving waters were reported not to be in compliance with current legislative requirements, and either a designated shellfish water, shellfish production area or a designated bathing area was located close to the waste water discharge point, a further degree of waste water treatment (e.g. disinfection in terms of faecal coliforms) was considered desirable.

The Urban Waste Water Treatment Regulations, 2001 designated fifteen estuarine water bodies as sensitive waters. These regulations require “more stringent treatment than secondary treatment or an equivalent treatment in respect of all discharges from agglomerations with a population equivalent of more than 10,000 into sensitive areas or the relevant catchment areas of sensitive areas where the discharges contribute to the pollution of these areas”. These Regulations also state that the requirement to comply with the specified treated effluent discharge standards “shall not operate to require the reductions of nutrients in discharges to estuaries, bays or coastal waters where the sanitary authority is satisfied that such reduction will have no effect on the level of eutrophication in the receiving waters”. Based on the complexity of this issue, the requirement for nutrient reduction facilities could not be accurately determined within the scope of this study unless the results of more detailed studies were provided.

Traditional bathing and mariculture areas in estuaries and coastal waters were assessed on a similar basis to the areas designated by current legislation, but investment for compliance with the standards specified in the associated regulations was considered to be a local water quality issue rather than a legislative requirement. A similar approach was adopted in terms of achieving and maintaining Blue Flag status for beaches and marinas. Again, while this may be very important to the area concerned, compliance with the specified water quality standards was considered a local issue rather than a legislative requirement and was identified as such.

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

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METHODOLOGY

6. TREATMENT PLANT CAPACITY

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SYNOPSIS

The purpose of this assessment was to establish the existing capacity of each waste water treatment plant. The issue of its compliance with present legislation, both in terms of the level of treatment provided and effluent discharge quality was also addressed, based on current and projected future waste water loads for treatment. In addition, any significant investment needs associated with the waste water treatment plant were identified.

This methodology was prepared to establish a standard approach for application to all of the treatment plants being assessed. It was based on the technologies and processes most commonly used throughout the country. Where other technologies or proprietary systems were in use the manufacturers' design data was used where available.

This study was not intended to be a detailed plant assessment, and any recommendations made are general in nature. For the purpose of uniformity of approach, standard loading rates were applied in the assessment of capacity of the unit processes. It is acknowledged that some plants operate effectively at higher or lower loading rates, but with reduced margins of safety. This was taken into consideration in determining the need for increased treatment capacity. Where original design figures were provided for recently constructed treatment plants, these were also taken into account.

The assessment identified the treatment stage with the lowest capacity, and this was considered to be the limiting stage or "pinch point" in the treatment process. If this has insufficient capacity, then investment is required. Individual items of equipment were not assessed, since any investment required for these will be small in the context of the overall scheme.

The impact of the effluent discharge from each waste water treatment plant on its receiving waters was addressed in terms of the available assimilative capacity. Where it was assessed that insufficient assimilative capacity was available comment was made on the requirement for an increased level of waste water treatment prior to discharge, or for an improvement in upstream water quality.

In addition to treatment capacity, the structural and performance condition of the treatment plant was assessed. A typical useful working life of 20years was assumed for all mechanical and electrical equipment, with all equipment of this age considered to be in need of overhaul.

Each of the existing plants was visited in the course of this study and assessed on the basis of the available information. Where treatment plants were planned or under construction, it is the status of the plant at the end of 2002 that was assessed and recorded in this study.

Septic tanks or other stand-alone primary or preliminary treatment systems were not assessed unless they served the majority of the catchment. However, in most cases available information was limited with no performance data available.

Compatibility with the recommendations of the current Sludge Management Plan (status at 2002) was determined in terms of the availability and adequacy of the necessary sludge handling and treatment systems, as well as the current and future sludge disposal route. The sludge liquors generated during the treatment of sludge imported from other sites and any other imported waste streams were included in the waste water load for treatment at the waste water treatment plant.

1.0 ASSESSMENT OF TREATMENT PLANT CAPACITY

1.1 INTRODUCTION

The following methodology for the assessment of waste water treatment plants has been prepared to establish a standard approach for application to all of the plants being assessed.

The purpose of this assessment is to establish the existing capacity of each waste water treatment plant, and to determine if it is capable of producing a treated effluent in compliance with statutory discharge standards, based on current (2002) and projected future (2022) waste water loads for treatment. In addition, it is also used to identify any significant investment needs associated with the waste water treatment plant. It is not intended to be a detailed plant assessment, and any recommendations are general in nature.

It is based on the technologies and processes most commonly used throughout the country. It is acknowledged, however, that there may be other technologies in use to a lesser extent, e.g. proprietary package type systems for smaller plants, or newer innovative sludge treatment technologies. These were assessed on the basis of manufacturer's design details where provided.

It is also acknowledged that there is variation in loading rates at which some processes can operate effectively. However, for the purpose of this study a typical loading and operating rate has been used for each process type and these are set out in the following sections of the report.

1.2 WASTE WATER TREATMENT

For the purpose of assessing the treatment capacity of the plant, the general waste water treatment process was divided into the following stages of treatment.

- Preliminary Treatment
- Primary Settlement
- Secondary Treatment
- Tertiary Treatment
- Sludge Treatment

The capacity of each stage was calculated, since some stages of the plant have greater flexibility in operation, and consequently greater treatment capacity. The objective was to identify the limiting stage or "pinch point" in the treatment process, and this was the stage with the lowest treatment capacity. If this was determined to have insufficient capacity, then investment was considered necessary.

It was not intended that individual items (such as blowers, mixers, interconnecting pump systems etc.) would be assessed, since any investment required for these will be small in the context of the overall scheme.

In addition to the treatment capacity, the structural and performance condition of the treatment plant was also assessed. A similar approach was adopted with regard to smaller components of the plant, but other major items such as buildings and other structures were included in the assessment.

1.3 LEVEL OF TREATMENT PROVIDED.

The adequacy of the level of treatment provided was determined based on compliance with current legislation. The Urban Waste Water Treatment Regulations 2001 (SI No. 254 of 2001) specify the level of treatment to be provided based on the size of the agglomeration, the nature and classification of the receiving waters as well as the requirement to ensure that the receiving waters satisfy any other relevant Community Directives.

The Regulations stipulate that treatment plants providing secondary treatment or an equivalent treatment shall be provided for population centres of certain sizes by specific dates as follows;

- for all discharges from agglomerations with a pe. of more than 15,000 no later than a date which the European Commission may agree pursuant to a request under Article 8 of the Directive but no later than 31/12/00
- for all discharges from agglomerations with a pe. of between 10,000 and 15,000 by 31/12/05
- for all discharges to freshwaters and estuaries from agglomerations with a pe. of between 2,000 and 10,000 by 31/12/05

These Regulations require a sanitary authority to install treatment plants which provide more stringent treatment than secondary treatment or an equivalent treatment in respect of all discharges from agglomerations with a population equivalent of more than 10,000 into sensitive areas or into the relevant catchment areas of sensitive areas where the discharges contribute to the pollution load of these areas from the year 2001 for areas specified in Part 1 of the Third Schedule and by 31/05/08 for those specified in Part 2 of the Third Schedule.

These Regulations require “appropriate” treatment of urban waste water in respect of:-

- all discharges to coastal waters from agglomerations with a population equivalent of less than 10,000 by 31/12/05

Appropriate treatment is defined as treatment of urban waste water by any process and/or disposal system which after discharge allows the receiving water to meet the relevant quality objectives and the relevant provisions of the Directive and of other Community Directives.

However, compliance with these Regulations shall not require the reduction of nutrients in discharges to estuaries, bays or coastal waters where the sanitary authority is satisfied that such a reduction will have no effect on the level of eutrophication in the receiving waters.

Compliance (or otherwise) with the above legislation was determined both in terms of the level of treatment provided and the quality of the treated effluent being discharged, since non compliance will necessitate investment. It was also noted where facilities were under construction, at design or procurement stage (with funding committed for such projects) in catchments that were not currently in compliance with the Regulations. It was the status of each scheme at the end of the year 2002 which was reported and recorded in this study as the “current” status, with future plans and commitments noted and highlighted.

The current performance of the treatment plant and its ability to comply with current discharge standards was assessed. Compliance of each scheme with the Urban Waste Water Treatment Regulations, 2001 in relation to the quality of treated effluent being discharged was recorded. The reason for the non-compliance (where known) was identified, for example as insufficient treatment capacity for the load discharged to the treatment plant, or mechanical or structural failure, or operational problems, etc.

1.4 WASTE WATER TREATMENT PROCESSES

To determine the current loading and spare capacity of the unit processes in the waste water treatment system it was considered necessary to make a number of general assumptions with regard to unit loading rates. It is however, recognised that there are process units in operation at some waste water treatment plants, which are able to consistently achieve their design objectives while operating outside the operating ranges, set out below. The general assumptions made are for the purpose of applying the same rates to all of the waste water treatment plants being assessed as part of this Study.

1.4.1 Preliminary Treatment

Compliance with the requirements of the UWWT Regulations (SI No. 254 of 2001) in terms of the representative sampling to be provided on the flow into and out of the treatment plant was recorded.

Compliance of the preliminary treatment plant with the requirements of the relevant Sludge Management Plan in relation to the provision of fine screening was recorded.

Odour, and other nuisance associated with the lack of washing or treatment/containment facilities for the screenings and grit was recorded where reported by the Local Authority.

The effectiveness or otherwise of the preliminary treatment stage was determined by the observation of gross solids getting caught in weirs, floating in subsequent stages of the treatment process, or causing blockages in pumps etc. The deposition of fats oils and grease on structures or equipment, or excessive wear due to grit in subsequent stages of the treatment process was also recorded where reported by the Local Authority.

1.4.2 Primary Treatment

In the treatment plants assessed this generally took the form of settlement in either upward flow or radial flow settlement tanks, or else in Imhoff tanks upstream of percolating filters in some older plants. The critical parameters considered in determining the capacity of primary settlement tanks were the surface area for settlement, and the retention time of the waste water in the tanks.

A primary settlement tank was considered overloaded if the retention time of the waste water in the tank was less than 2 hours based on a flow of 3DWF. If the flow receiving full secondary treatment was greater than 3 DWF, then a minimum retention time of 1.5 hours was considered acceptable.

The maximum surface loading or overflow rate of primary settlement tanks at peak flow was taken as 1.5 $m^3/m^2/hr$.

In terms of treatment performance it was assumed for this study that 30% of the incoming BOD load was removed and 50% of the suspended solids load was removed in the primary settlement tanks. In practice slightly higher removal efficiencies may be achieved on some sites, while lower removal efficiencies may be achieved on other sites depending on the industrial proportion in the incoming waste water and on operating conditions in the tank.

In some catchments, septic tanks are used as the principal form of waste water treatment system. The treatment capacity of these was determined in accordance with the standard TR.

1.4.3 Secondary Treatment

The municipal waste water treatment systems encountered in this study were generally biological treatment systems, either suspended growth or attached growth systems, or combinations of both. These are all generally referred to as either activated sludge systems or biofiltration systems. The newer treatment plants tended to be activated sludge systems because of the operational problems and odour nuisance difficulties associated with the biofiltration systems. There are other technologies available but not in widespread use in Ireland.

Suspended Growth – Activated Sludge Systems

The principle types of activated sludge systems together with their key operating parameters are listed below in Table 1.1. Other systems now gaining popularity, such as the Sequencing Batch Reactors (SBR) represent variations in the configuration of the activated sludge system. Of the processes listed below, all (except the high rate system) produce a treated effluent in compliance with the Urban Waste Water Treatment Regulations at these loading rates when fed with normal municipal waste water. The high rate system generally achieves approximately 60 – 70 % BOD removal, and requires a subsequent stage of treatment to achieve the treated effluent quality required for secondary treatment systems.

Table 1.1
Typical Operating Parameters Range for Activated Sludge Processes

Process	F/M	BOD Loading	Hydraulic Retention Time	MLSS Concentration	Sludge Production
	kg BOD / kg MLSS.day	kg BOD / m^3.day	hours	mg/l	kg ds/kg BOD removed
Conventional	0.2 – 0.3	0.5 – 1.0	5 – 14	2,000 – 3,000	0.5 – 1.0
Conventional (with Nitrification)	0.10 – 0.15	0.3 – 0.5	14 - 20	2,000 – 4,000	0.5 – 0.7
Extended Aeration (with Nitrification)	0.05 – 0.15	0.25 – 0.3	20 – 30	2,000 – 6,000	0.5 – 0.6
High rate Activated Sludge	1.0 – 2.5	1.6 – 16	2.5 – 3.5	5,000 – 8,000	0.8 – 1.0

In determining the actual treatment capacity of a system, average values were taken, as set out in Table 1.2.

In addition to the above it was also necessary to take into account the oxygen output of the aeration system. In terms of aeration capacity, average oxygenation capacities of 1.6 kg O_2/kW for surface aerators, and 2.2 kg O_2/kW for diffused air aeration systems were assumed when no data was provided.
Please define F/M & MLSS

Table 1.2
Design Operating Parameters for Activated Sludge Processes

Activated Sludge Process	F/M	BOD Loading	Hydraulic Retention Time	MLSS Concentration	Sludge Production
	kg BOD / kg MLSS.day	kg BOD / m^3.day	hours	mg/l	kg ds/kg BOD removed
Conventional	0.25	0.75	10	2,500	0.75
Conventional with Nitrification	0.13	0.40	18	3,000	0.7
Extended Aeration (with Nitrification)	0.075	0.25	25	3,000	0.6
High rate Activated Sludge	1.75	4.0	3.0	6,500	0.9

Attached Growth – Biofiltration Systems

The following are normal operating ranges for Attached Growth (Biofiltration) Systems capable of producing treated effluent in accordance with the standards of the Urban Waste Water Treatment Regulations, 2001. It was considered that the high rate and roughing filters would not however, provide full treatment to achieve a discharge concentration of < 25 mg BOD/litre and < 35 mg suspended solids/litre, and would require a further treatment stage.

Table 1.3
Typical Operating Rates for Attached Growth Systems

Treatment Process	Hydraulic Loading	Organic Loading	Sludge Production
	m^3/m^2/day	kg BOD/m^3/day	kg ds/kg BOD/day
Rotating Biological Contactor	N/A	<5g BOD/m^2.day	< 0.4
Low Rate	1.0 – 3.75	0.08 – 0.32	0.4 – 0.6
Intermediate Rate	4.0 – 9.5	0.24 – 0.48	0.6 – 0.8
Biological Aerated Filter (BAF) without nitrification	24 – 96*	0.25 – 2.0**	0.75
BAF with nitrification	24 – 96*	0.25 – 1.0**	0.60
High Rate	9.5 – 28.0	0.48 – 0.96	0.8 – 1.0
Roughing Filter	28 - 47	0.8 – 1.6	> 1.0

Where:
m^3/m^2.day represents the daily flow applied per m^2 of bed surface area
kg BOD/m^3.day represents the daily BOD load applied per m^3 of total bed volume
kg ds/kg BOD.day represents the daily mass of total suspended solids produced per kg BOD removed
N/R Not relevant
* refers to daily flow applied per m^2 media bed surface area
** refers to daily BOD load per m^3 total empty bed contact volume

However, for the purpose of calculating future capacity requirements the following typical values were used as set out in Table 1.4 .

Table 1.4
Design Operating Rates for Attached Growth Systems

Treatment Process	Hydraulic Loading	Organic Loading	Sludge Production
	m^3/m^2.day	kg BOD/m^3.day	kg ds/kg BOD.day
Rotating Biological Contactor (RBC)	N/R	5 g BOD/m^2.day	0.4
Low Rate	2.0	0.12	0.5
Biological Aerated Filter (BAF) without nitrification	60*	1.5	0.75
BAF with nitrification	60*	0.65	0.6
High Rate/Roughing Filter	36	1.2	1.0

Additional Treatment:

Additional treatment in the form of nutrient reduction and disinfection was encountered at some waste water treatment plants.

The requirement for nitrogen removal was determined by the sensitive area classification of the receiving waters in the Urban Waste Water Treatment Regulations 2001 and by the assimilative capacity of the receiving waters. In terms of nitrogen reduction, nitrification was provided at some plants, while both nitrification and de-nitrification were provided at other sites.

Nitrogen removal systems encountered were biological, and incorporated nitrification and denitrification processes as part of the secondary treatment stage. It was considered that nitrification would be achieved by operating at the loading rates set out above in Tables 1.2 and 1.4, and also in the low loaded biofiltration system. However, an adequate dissolved oxygen concentration is also necessary.

To achieve de-nitrification an anoxic zone was considered necessary. In the activated sludge systems this is achieved by connecting the feed to the aeration tanks with the return activated sludge and recirculated aerated mixed liquor in the absence of an external oxygen supply. Typically this anoxic zone can be the equivalent of between 33 % and 66 % of the operating volume of the aerated section of the activated sludge system. For effective denitrification it was assumed that this zone would correspond to 50 % of the aerated volume and be additional to this volume.

In a biofiltration system nitrification is achieved in the biofilter at loadings specified above, while denitrification takes place in a separate reactor. The volume of the denitrification reactor required was taken to correspond to approximately 50 % of the operating volume of the nitrification reactor.

The adequacy of the nitrification and denitrification systems could only be determined where adequate influent and effluent monitoring data was provided.

The requirement for phosphorus removal was determined by the sensitive area classification of the receiving waters in the Urban Waste Water Treatment Regulations 2001, the assimilative capacity in the receiving waters and the Local

Government (Water Pollution) Act 1977, (Water Quality Standards for Phosphorus) Regulations, 1998. This will be determined by the analyses of the receiving waters.

The most common form of phosphorus reduction system encountered was chemical precipitation (using either ferric or alum salts), with biological phosphorus removal systems encountered at very few waste water treatment plants.

The effectiveness or otherwise of the phosphorus removal system was determined where the concentration of phosphates in the influent and treated effluent was provided and compared with the treated effluent discharge standards.

The type of disinfection system most widely encountered at the wastewater treatment plant sites was ultra violet disinfection. The capacity of these systems was based on the data provided by the local authority in terms of m^3/hr of waste water which could be treated. The adequacy of the disinfection system, was confirmed only where coliform concentrations in the treated effluent were provided.

Secondary Settlement Systems

For activated sludge systems the capacity of the associated secondary settlement tanks was calculated bases on a maximum upward flow velocity of 1.0 m^3/m^2.hr with a minimum retention time of 2 hours at peak flow.

For a biofiltration system the capacity of the associated settlement tanks (also referred to as humus tanks) was calculated based on a maximum upward flow velocity of 1.2 m^3/m^2.hr with a minimum retention time of 2 hours at peak flow.

To express the capacity in terms of population equivalent, the maximum acceptable hourly flow was calculated, and based on the peak flow factor (i.e., multiple of DWF on which the plant was designed), the daily dry weather flow was calculated. The per capita wastewater flow (refer to Table 2.5 of each catchment report) applicable to the catchment in question was then used to calculate the capacity of the settlement tanks in terms of population equivalent.

1.4.4 Tertiary Treatment

Tertiary treatment is the term used to cover additional treatment processes to reduce the BOD5 and suspended solids concentration to less than those specified for secondary treatment in the Urban Waste Water Treatment Regulations, 2001. These processes include filtration, and the use of irrigation systems, reed beds or constructed wetlands.

Filtration of the treated effluent was provided on some sites to produce a treated effluent with BOD and suspended solids concentrations of < 10 mg/l. The requirement for this level of treatment was usually based on the assimilative capacity of the receiving waters. Filtration was generally provided in deep bed sand filters. On other sites a wedge wire screen was fitted adjacent to the decanting channel of the final settlement tanks.

The filtration capacity of sand filters was based on a typical filtration rate of 5 m^3/m^2.hr. The capacity of screened settlement tanks was based on a maximum upward flow rate of 1.0 m^3/m^2.hr.

The effectiveness or otherwise of these systems was determined from the concentration of suspended solids reported in the treated effluent analysis.

Constructed wetlands and reed beds are now being used for tertiary treatment on some waste water treatment plants. For tertiary treatment these would generally have a surface area of corresponding to between 0.5 and 1.0 m^2/p.e. In terms of calculating spare capacity a loading rate of 1.0 m^2/p.e. was used.

1.4.5 Sludge Thickening

The type of sludge thickening most commonly used in Ireland is gravity thickening either using a tank (with or without a rotating picket fence assembly fitted), or a belt thickener. The optimum loading rates for these depends on the type of sludge to be thickened. For the purpose of estimating capacity for this study the loading rates set out in Table 1.5 below were used for Gravity Thickener Tanks.

Table 1.5
Sludge Thickener Capacities

Sludge Type	Solids Loading	Solids Loading	Thickened Sludge
	kg/m^2/day	kg/m^2/ hr	% d.s.
Primary Sludge	88 – 137	4.7	6 %
Trickling Filter Humus Sludge	34 – 49	1.7	4 %
RBC Sludge	34 – 49	1.7	3 %
Air Activated Sludge	12 – 34	1.0	3 %
Extended Aeration Sludge	24 – 34	1.2	3 %
Primary + Humus Sludge	59 – 98	3.3	5 %
Primary + RBC Sludge	49 – 78	2.6	4 %
Primary + Air Activated Sludge	39 – 78	2.4	4 %
Waste Activated + Humus Sludge	12 – 34	1.0	3 %

A further criteria in determining the capacity of gravity sludge thickening tanks was the requirement to provide sufficient storage capacity for a long weekend, i.e., a total storage capacity equivalent to 4 days sludge production.

In newer waste water treatment plants, Gravity Belt Thickeners are generally used to thicken waste activated sludge and extended aeration sludge which are difficult to thicken to this level in a tank. They typically achieve 5 – 7 % dry solids concentrations when fed with different types of sludge at a loading rate of 200 kg dry solids/hr per m of belt width. The actual capacity depends on the type of sludge and the width of the belt on the thickener, and was based on data provided by the Local Authority. For the purpose of estimating capacity a loading rate of 200 kg ds/hr.m was used in the absence of any other information.

1.4.6 Sludge Dewatering

Dewatering of municipal waste water sludge was generally achieved using either belt dewatering presses or centrifuge decanters. The performance and treatment capacity of these depends on the type of sludge to be dewatered and on the age and model of unit. In general, the capacity and performance recorded in the report was based on actual information provided by the Local Authority. Table 1.6 provides typical loading rates and associated product solids levels for standard belt dewatering systems. It should however, be noted that the older single belt presses generally produce a dewatered cake at the lower end of the range given.

Table 1.6
Capacities of Sludge Dewatering Systems

Sludge Type	Sludge Loading Range	Sludge Loading	Cake Dryness Range	Cake Dryness
	kg ds/hr.m	kg ds/hr.m	% dry solids	% dry solids
Extended Aeration	100 - 200	120	11 – 15 %	14 %
Activated Sludge	100 – 200	150	15 – 20 %	18 %
Mixed Primary + Activated Sludge	350 – 450	400	18 – 25 %	22 %
Digested Sludge	300 – 400	350	20 – 25 %	23 %

For decanter centrifuges the operating and design capacities as well as the actual performance of the units were obtained from the Local Authority.

1.4.7 Sludge Digestion

It was not intended that each element of the sludge digestion process would be analysed in detail as part of this study. The key element which is considered is the actual sludge digestion tank since it is the single largest component of the process.

The capacity of a mesophillic anaerobic digestion system was determined based on a hydraulic retention time of 15 days (while retention periods of between 12 and 25 days would be acceptable). If the digested sludge was to be reused as biosolids in agriculture, it was considered necessary that the digester should be preceded by a pasteurisation stage.

For a thermophillic aerobic digester a hydraulic retention time of between 5 and 8 days for the sludge was considered acceptable, with the optimum retention time in the aerobic digester of 7 days for a sludge with a dry solids concentration of approximately 6 – 8 % being used in calculating the capacity of the system.

1.5 COMPLIANCE WITH SLUDGE MANAGEMENT PLAN

The data collection questionnaire requests information on the implication of the relevant County Sludge Management Plan on each of the waste water treatment plants being surveyed. Most Local Authorities (County and City Councils) had completed their Sludge Management Plans at this stage. However, the majority of these were still in draft form, with the final strategy to be adopted undecided in some areas. However, in the absence of alternative information the data and information contained therein was considered to provide a good indication of both the short-term and long-term policy objectives and was recorded in this report.

Where a waste water treatment plant was designated as a hub centre for the treatment of sludge, it was considered necessary to provide at a minimum sludge reception and screening facilities, plus advanced sludge treatment facilities, and also storage facilities for both untreated sludge and the biosolids product. It was considered that the sludge treatment process to be used would be capable of producing a biosolids product compatible with its recommended end use

Where a waste water treatment plant was designated as a satellite centre for sludge treatment it was considered necessary for it to incorporate sludge reception facilities for imported sludge, sludge dewatering facilities and adequate storage for both liquid and dewatered sludge. At both the satellite and hub centres, traffic management systems together with wheel washing facilities for all vehicles leaving the site were also considered essential.

At the remote waste water treatment plants it was considered necessary to provide adequate storage on site to facilitate economic transportation of sludge to the satellite for dewatering.

The adequacy and compatibility of the existing systems with the recommendations of the Sludge Management Plans were assessed in terms of the existing facilities and the space availability on site for the provision of the necessary facilities. In addition the treatment of sludge liquors generated during the treatment or processing of imported sludges was considered and the associated loading on the waste water treatment process was calculated and added to the load reaching the WWTP via the sewer network.

Any deficiencies or shortfalls in treatment capacity were identified and used to determine the requirement for investment at the waste water treatment plant.

Department of the Environment, Heritage and Local Government

National Urban Waste Water Study

Volume 2, Part A

METHODOLOGY

7. ADDITIONAL SURVEY REQUIREMENTS

TABLE OF CONTENTS

SYNOPSIS

The objective of survey work is to allow actual or potential network problems to be identified and to provide the data necessary for solutions to be developed. The types of survey for which quantities were estimated are listed below.

- Manhole survey and mapping
- Sewer survey for structural assessment
- Flow & rainfall survey for model verification
- Impermeability survey to define separate & combined drainage systems
- Connectivity survey to identify sewer routes & drainage boundaries

The basic philosophy was to identify and investigate the "core area" sewers, ie. those for which the consequence of actual failure would outweigh the cost of pre-emptive renovation or upgrading plus any connecting sewers. Central to this is the provision of survey data necessary to carry out structural and hydraulic assessment of this area and develop an outline rehabilitation strategy or "Drainage Area Plan".

Manhole survey work was considered in two stages. "Initial Survey" comprising the minimum work necessary to identify the core area sewers and provide the data to build a hydraulic model and "Full Survey" to provide complete catchment records. Full Survey is not required for the purpose of developing the network rehabilitation strategy or Drainage Area Plan. However, it will be valuable in the long run to provide information for sewer maintenance and catchment development.

The pilot phase of the study identified significant gaps in data availability and reliability. A methodology was developed to check data quality and make good any gaps or questionable figures with standard quantities, which we are related to catchment population. For the purpose of estimating survey quantities and costs on a consistent basis across the country, these standardised quantities are used wherever quality assured data was not available.

1.0 INTRODUCTION

1.1 THE BRIEF

The Brief states that,

- '*Any major flow surveys, sewer surveys, etc. carried out previously by the local authority or their agents shall be assessed…..for their usefulness and reliability.'*
- *'Having completed this analysis of the existing survey data the consultants will be required to determine what, if any, additional work is required to collect sufficient useful data in future by the local authority.'*
- *'On this basis, an assessment of needs and associated costs etc., of additional network analysis is to be developed and presented.*'

The objective of the work was to allow actual or potential structural, hydraulic or environmental problems within the sewerage network to be identified and to provide the data necessary for solutions to be developed. However, it should be noted that the assessment of environmental issues requiring pollution or dispersion modelling was beyond the scope of this study and was not considered.

Assessment of the usefulness and reliability of existing survey data was based on the LA questionnaires returns as described in Section 2.0 below. Having determined where the available survey data was inadequate for future investigation purposes, the additional survey requirements were quantified all as described in Section 3.0. The estimated costs for both future surveys and networks analysis were then assessed and are presented in Part D of this volume.

2.0 ASSESSMENT OF EXISTING SURVEYS

2.1 QUALITY CONTROL CHECKS

Quality control checks to assess the usefulness and reliability of data, were based on the specifications in the documents listed below which are recognised model or standard documents in Ireland. These were prepared by or under the auspices of the following UK organisations; the Water Services Association (WSA), the Foundation for Water Research (FWR) and also the Water Research Centre (WRc) in conjunction with the Water Authorities Association (WAA).

The relevant document titles are:

- *Model Contract Documents for Manhole Location Surveys and Production of Record Maps,*
- *Sewer Condition Inspection by CCTV and Man Entry,*
- *Short Term Sewer Flow Surveys*
- *A Guide to Short Term Sewer Flow Surveys for Sewerage Systems*.

Details of major surveys were recorded in Section 5 of the Sewerage Network Questionnaire, which also asks for confirmation that quality control checks were carried out and the data was of acceptable quality. The relevant checks are summarised below

2.1.1 Manhole Survey & Mapping

Quality control checks for manholes and record maps comprise a validation check and a site check. Clause 3.22 of the relevant document above specifies a 5% site resurvey and validation of the records maps by the Engineer for each 100 manholes or other structures recorded. In the event of failure, quality control checks are repeated until the Engineer is satisfied that the work has met the specification.

Where resurvey has been carried out (possibly following initial failure of checks) and the Engineer has been satisfied with the final quality checks, data is of acceptable quality.

2.1.2 Sewer Condition Inspection

Quality control checks for sewer condition inspection relate to accuracy of the header information and of the detail (measurements etc) and also the picture quality.

The quality control procedures and checks are described in clauses 3.36 to 3.39 of the relevant document. Levels of accuracy are set out in clause 6.25 and standard quality control log sheets are illustrated in Appendix B of the relevant model document as above.

Quality may be deemed acceptable where initial defects in the data (leading to a failure) were rectified prior to final submission of the survey report.

Where the specified quality control procedures did not form part of the contract, any data held by the LA is considered as unacceptable, unless it was confirmed that the survey output data was checked by the LA and accepted with reference to the header information, detailed measurements and picture quality.

2.1.3 Short Term Sewer Flow Survey

Quality control checks for Flow Survey relate to;

- instrument calibration and sewer dimensions,
- instrument serviceability i.e. the percentage of instruments which are operational and the percentage of the time they are operational
- relative sewer flow depth and velocity at each monitor
- acceptable catchment response ratios
- number of suitable storms and dry weather flow events recorded
- Flow/volume balance

Sewer measurement, instrument calibration and serviceability checks are detailed in clauses 3.19 to 3.23 of the *Model Contract Document for Short Term Sewer Flow Surveys* . The catchment response ratio and the suitability of storms is dealt with in Tables 1 and 2 of *A Guide to Short Term Sewer Flow Surveys for Sewerage Systems.* Clause 4.2 of the same document also deals with quality assurance checks on data returned from site. Rigorous checking as above is essential.

Where it was confirmed by the LA that the above checks have been implemented and gave acceptable results the data quality was considered acceptable.

3.0 ADDITIONAL SURVEY REQUIREMENTS

3.1 GENERAL APPROACH

3.1.1 Data Sources

The Sewerage Network Questionnaire, prepared to facilitate the collection of data from the local authorities, was the primary source of information such as catchment area, length of sewers and number of manholes. However, the pilot phase of the study identified significant gaps in data, which varied from an estimate of the total length of sewers and no plan, to a detailed breakdown of the network by length, sizes and condition. Where the data was not available, the sewer length, diameter range and the number of manholes in the catchment were estimated from average figures given in Part A3, the Sewerage Network Inventory.

For the purpose of estimating survey quantities and costs on a consistent basis, standardised quantities from the above study were used where quality assured data was not available. Standard data on depth to invert was based on recently completed sewerage projects.

3.1.2 Identification of Needs

The general approach to sewer network investigations in Ireland has drawn on the methodologies developed by UK Water Research Centre (WRc) and described in the Sewerage Rehabilitation Manual* (SRM). The SRM approach is based on the application of risk management to optimise expenditure; the risks being, failure to meet legal requirements and/or to provide adequate standards of service or the risk of incurring excessive costs for maintenance, repair and/or rehabilitation of the sewerage network. The solution at the planning stage is to identify those elements of the system where the consequences of failure will be most severe and to develop an integrated upgrading approach such that the rehabilitation cost is minimised; in SRM terminology, to carry out a *Drainage Area Study (DAS)* and develop a *Drainage Area Plan (DAP)*.

Central to the above approach is identification of the *core area* of the network which comprises, (a) the *critical sewers* where repair, following structural failure, would be significantly more costly than pre-emptive rehabilitation plus, (b) the sewers where there are hydraulic or operational problems (flooding) and (c) any interconnecting sewers. The SRM criteria used to identify *critical sewers* may require review before they can be considered wholly applicable in Ireland, however the general principles used to identify *Core Area* and *critical sewers* remain valid; i.e. screening for critical sewers is based on:

- Type of sewer, pipe material and diameter
- Soil type and depth to invert of sewer
- Traffic levels and alternative routes if a street is closed by a sewer collapse
- Use of street in which sewer runs, e.g. main shopping street, hospital access.
- Infrastructure above/adjacent to the sewer, e.g. railways, buildings etc.
- Potential to cause pollution of environmentally important watercourse.

Having identified the core area sewers, subsequent survey, assessment and rehabilitation works are concentrated there. The Sewerage Network Inventory Study, which looked at the output from a number of sewerage investigations, gave an average for the *core area* sewers of around 25% of the total sewer length and this was taken as the appropriate length for quantity and cost estimating purposes.

* Sewerage Rehabilitation Manual, 4th Ed. WRc, 2002

For the purpose of identifying survey requirements, three catchment situations were defined:

- Catchments where there were reasonably comprehensive record plans at a scale of 1:2500 or better (data Confidence Grade 3 or better).
- Catchments with few if any records (data Confidence Grade 4 or 5).
- Uncomplicated small/rural catchments with a population of not more than 5,000, regardless of the status of the records.

Catchments were further defined by (a) whether or not they include partially separate drainage areas and (b) whether or not the records are of recent origin and quality assured, (i.e. Confidence Grade 1or 2).

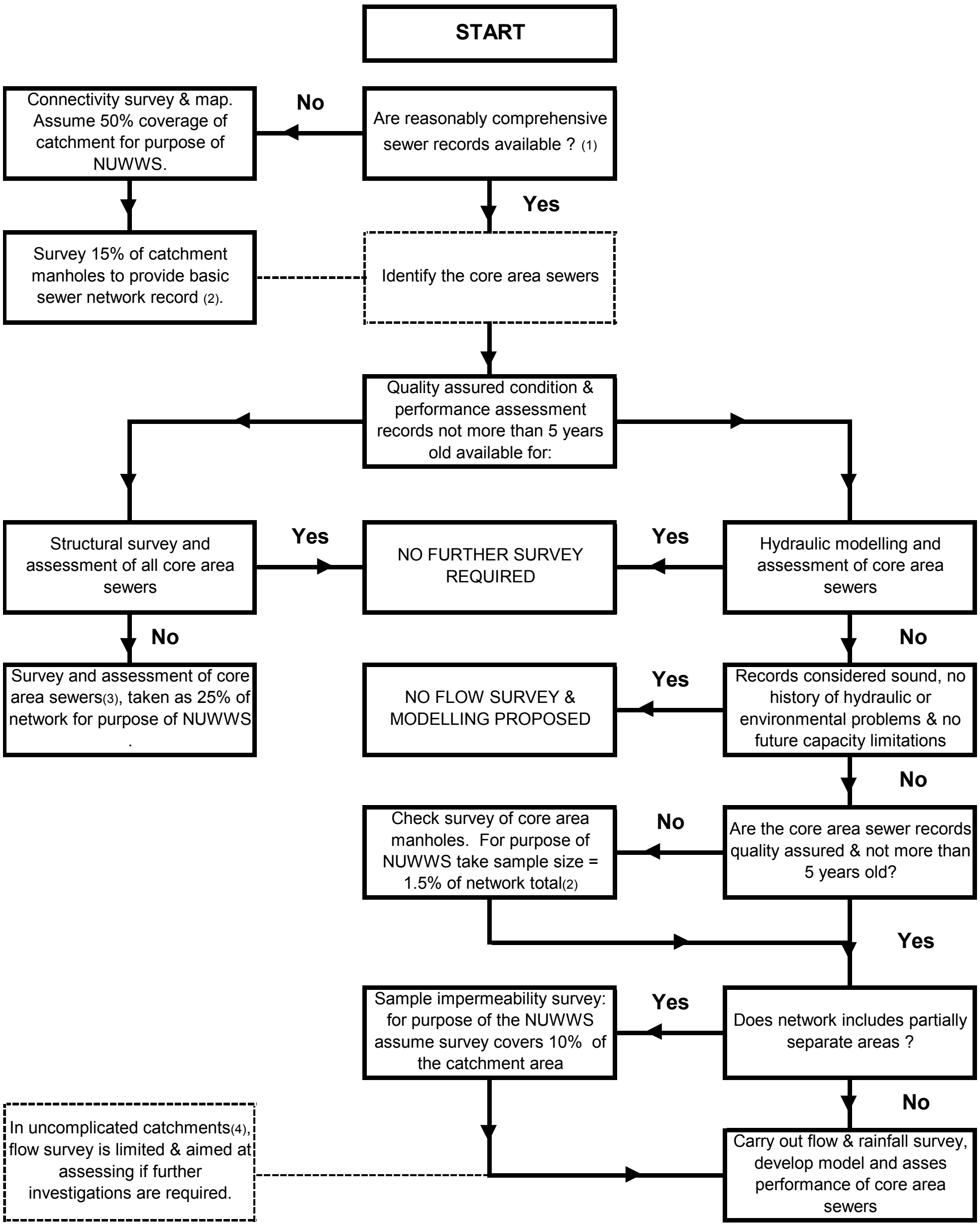
Manhole survey work was considered in two stages. "Initial Survey" comprising the minimum work necessary to identify the core area sewers and provide the data to build a hydraulic model and "Full Survey" to provide complete catchment records. Full Survey is not required for the purpose of developing the Drainage Area Plan (DAP) and carrying out associated network upgrading. However, it will be valuable in the long run to provide information for sewer maintenance and development work.

Where the catchment records were poor, an initial Connectivity Survey was assumed to identify/prove the sewer routes following which, survey of selected manhole would be carried out to provide pipe diameter, depth to cover and invert etc.

A full Drainage Area Study including structural and hydraulic assessment, as defined in the SRM, may not be necessary in all cases. For small uncomplicated catchments where there are good records (Confidence Grades 1 or 2), no known hydraulic performance problems and no known limitations to future development, work may be limited to structural assessment. A threshold population of 5,000 is used to differentiate between catchments for the purpose of this study. Where there is a need to confirm hydraulic performance, limited flow survey and simple hydraulic assessment may be sufficient to determine whether or not further investigations are necessary.

The process for identification of survey requirements, including the volume of work, is illustrated in Figure 3.1 and described in the following section. The cost of the identified survey work is discussed in Part D of this Volume.

Figure 3.1: NUWWS Initial Survey Requirements Chart



Notes:

1. Sewer plans covering the network at scales of 1:2500 or better, (eg. 1:1250 scale) with a Confidence Grade of 3 or better for the purpose of the NUWWS.
2. If 15% of the catchment manholes are selected for survey on account of inadequate records, do not allow for a further 1.5% quality check survey.
3. In small uncomplicated catchments the length of core area/critical sewer may be small and the benefit of survey questionable. However, for the purpose of the NUWWS survey of the core area sewers, comprising 25% of the total length of the network is assumed in all cases.
4. Catchments of ≤ 5,000 population where simple hydraulic analysis is possible are classified "uncomplicated".

4.0 METHODOLOGY

The use of standardised relationships for length of sewer and numbers of manholes ensures that, globally the estimate of survey costs is of the correct order, and not skewed between counties that may have carried out more or less survey and have a greater or lesser number of catchment specific figures.

4.1 CONNECTIVITY SURVEY

Where the sewer network inventory data is Confidence Grade 3 or better, go to Section 4.2, Manhole Survey, as a connectivity survey is not required.

The function of a Connectivity Survey is to identify the layout of the network, the drainage boundaries and the types of system (combined, separate, and partially separate). The output of such a survey will be a map showing the sewer network, identifying storm, combined and foul systems, the drainage area boundaries and giving indicative pipe sizes and depths at key points

The areas to be surveyed and the survey costs depend on the quality of the sewer records and the type of system. Where sewer records are poor (Confidence Grade 4 or 5), a connectivity survey covering 50% of the catchment area (all of the Core Area plus one third of the outer area) was assumed. In this case, no allowance is made under Section 4.5 detailing *Impermeable Area Survey* requirements.

4.2 MANHOLE SURVEY

The total number of manholes and the number in the core area was estimated using the relationships given in the Sewerage Network Inventory Assessment in Part A3.

The number of manholes to be included in the Initial Survey is based on the quality of available records as indicated below.

a) Reasonably comprehensive quality assured core area records , Confidence Grade 1 or 2: No survey required,
b) Reasonably comprehensive core area records that are not quality assured and/or are more than 5 years old, Confidence Grade 3: Initial survey of 1.5% of the total – this equates to a 6% check of the core area manholes.
c) Inadequate records or no records, Confidence Grade 4 or 5: Initial survey of 15% of the total. This equates surveying approximately 30% of the core area plus 10% of the surrounding area manholes.

4.3 CCTV SURVEY

The length of sewer subject to CCTV survey and structural assessment comprises the total length of the core area sewers less only such sewers for which quality assured survey records exist. The core area is estimated to comprise approximately 25% of the total sewer length, estimated in accordance with the formulae given in Part A3 Sewerage Network Inventory.

4.4 FLOW & RAINFALL SURVEY

Short term flow and raingauges records are used to verify a computer model by allowing events to be simulated and then checking flows at key points in the system to ensure the difference between measured and simulated hydrographs are within permissible limits.

Rain gauge densities recommended by the UK WaPUG Code of Practice[2] are between 1+1 per km^2 to 1+1 per 4 km^2. For the purpose of estimating quantities, an indicative figure of 1+2 per km^2 is assumed. The cost of rain gauges is a small fraction of the total flow survey costs and the precision of this number is not significant.

The number of flow monitors is normally determined by reference to key features of the sewer network; the number of cSOs, ancillary structures (e.g. detention tanks & pump stations), major sub-catchments or branches and reported flooding areas. The number of monitors may be estimated roughly as, 1 x (nr of major pump stations & flooding problems) + 2 x (nr of cSOs + detention tanks + major junctions or sub catchments).

In practice, available catchment data was not considered sufficiently reliable to allow consistent estimating of the number of flow monitors. A review of previous studies suggests that for the purposes of a DAP model, the number of flow monitors is likely to be in the range 1 per 1000 population to 1 per 3,000 population. For consistency it is therefore proposed that the number of flow monitors be estimated as Nr = [3 + (1 per 2,000 population)] with fractional numbers rounded up.

4.5 IMPERMEABLE AREA SURVEY

Impermeable Area Surveys (IAS) are carried out where there is potential uncertainty regarding the separation of foul and surface water particularly at domestic property level, in the case of partially separate sewerage catchments. In catchments known to include partially separate systems, an allowance is made for IAS covering a standard 10% of the catchment.

4.6 POLLUTION MODELLING STUDIES

Urban Pollution Modelling (UPM studies) or coastal pollution modelling using pollutant and/or marine surveys are likely to be identified following completion of a Drainage Area Study (DAS). They are relatively costly and time taking and justification for such a study is likely to be a large number of cSOs, which it may be costly to deal with, or a potentially serious water quality problem. Assessment of the extent and cost of such work is beyond the scope of this study and will await more detailed scoping studies.

[2] Code of Practice for Hydraulic Modeling of Sewer Systems, Wastewater Planning Users Group, Version 3.0, Nov. 2002

4.7 QUANTITIES

For the purpose of the catchment reports, a quantitative survey summary is provided as below.

Type of Survey	Units	Quantities	
		Initial Survey	Full Survey
Manhole survey & mapping	No of Manholes		
Sewer survey	Km of sewer		
Flow & Rainfall survey	Flow monitors		
	Rain gauges		
Impermeability survey	Ha.		
Connectivity survey	Ha.		