Attachment B.8

CORK COUNTY COUNCIL

SITE NOTICE

APPLICATION TO THE ENVIRONMENTAL PROTECTION AGENCY FOR A WASTEWATER DISCHARGE LICENCE

In accordance with the Waste Water Discharge (Authorisation) Regulations 2007, Water Services Southern Division, Cork County Council, County Hall, Carrigrohane Road, Cork is applying to the Environmental Protection Agency for a Wastewater Discharge Licence for Kinsale Agglomeration at the following locations:

Plant Name	Location	National Grid Ref.
Kinsale WWTP (Proposed)	**Commoge, Kinsale**	**E162957 N050111**

Discharge	Function	Townland	Receptor	Grid Reference
Primary	**Main**	**World's End**	**Kinsale Harbour**	**E164238 N049703**
Proposed Primary	**Main**	**Commoge**	**Kinsale Harbour**	**E162615 N049527**
Secondary	**Minor Outfall**	**Summercove**	**Kinsale Harbour**	**E165485 N049801**
Secondary	**Minor Outfall**	**Scilly**	**Kinsale Harbour**	**E164236 N050240**
Secondary	**Minor Outfall**	**Scilly**	**Kinsale Harbour**	**E164468 N050350**
Secondary	**Minor Outfall**	**Pier Road**	**Kinsale Harbour**	**E163979 N050357**
Secondary	**Minor Outfall**	**Pier Road**	**Kinsale Harbour**	**E163985 N050374**
Secondary	**Emergency**	**Pier Road**	**Kinsale Harbour**	**E164168 N050069**
Secondary	**Minor Outfall**	**Compass Hill**	**Kinsale Harbour**	**E163042 N49567**

It is intended to submit the Environmental Impact Statement associated with the provision of the proposed Waste Water Treatment Plant to the Agency along with the Application.

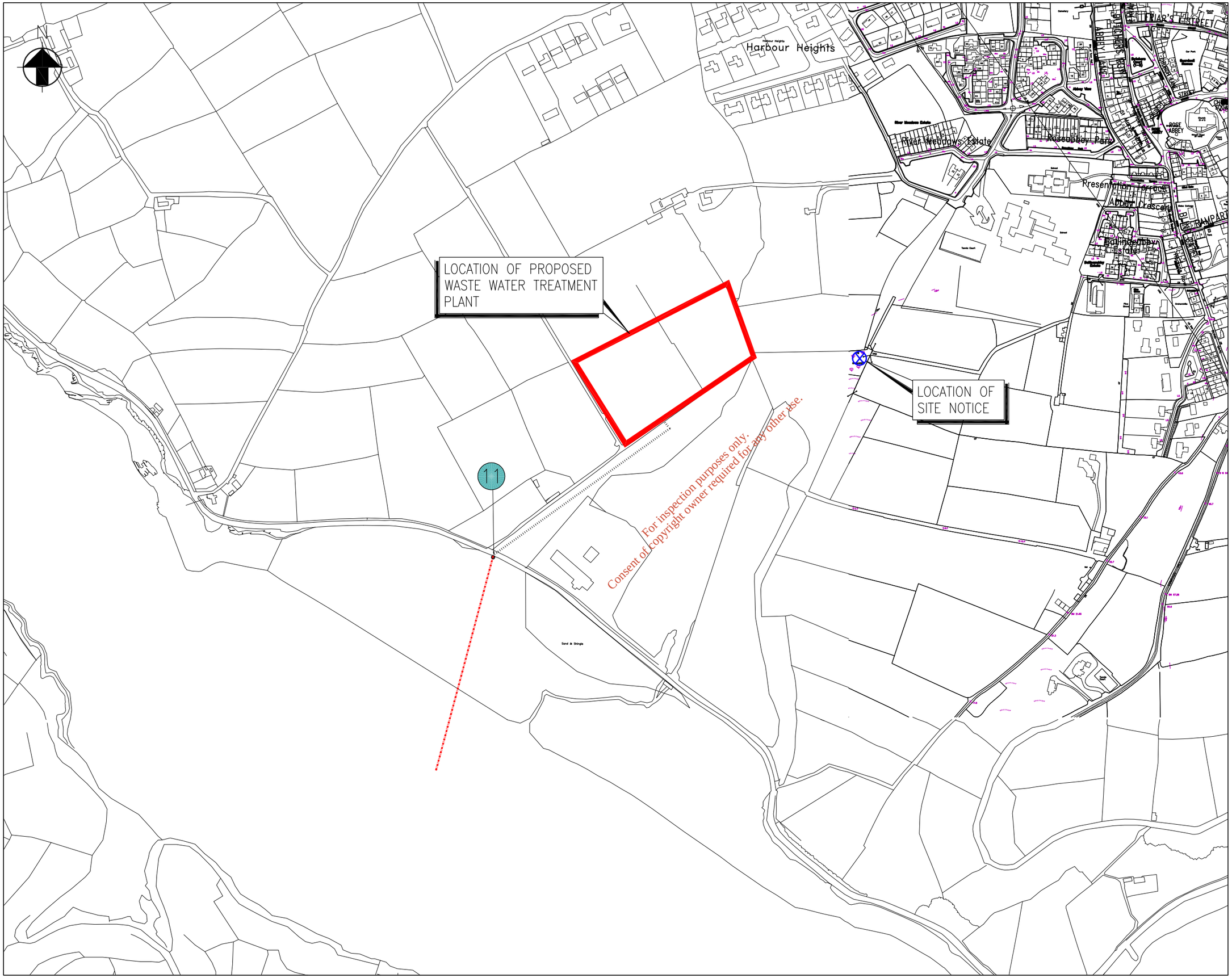
A copy of the application for the Waste Water Discharge Licence, the Environmental Impact Statement and such further information relating to the application as may be furnished to the Agency in the course of the Agency's consideration of the Application shall as soon as is practicable after receipt by the Agency be available for inspection or purchase at the

- **Environmental Protection Agency, PO Box 3000, Johnstown Castle Estate, Co. Wexford, Lo Call 1890 335599 Telephone: 053-9160600 Fax: 053-9160699 Email:info@epa.ie**

and at

- **Cork County Council Offices, Water Services South, County Hall, Carrigrohane Road, Co. Cork, Telephone: 021 - 4276891Fax: 021 - 4276321.**

Submissions in relation to the application may be made to the Environmental Protection Agency at its headquarters described above.



NOTES

1. ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL RELEVANT SPECIFICATIONS, BILLS OF QUANTITIES, ARCHITECTURAL, SERVICES AND ENGINEERING DRAWINGS.
2. ANY DISCREPANCIES BETWEEN THESE DOCUMENTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER.
3. DRAWINGS ARE NOT TO BE SCALED.
4. REPRODUCED FROM THE ORDNANCE SURVEY BY PERMISSION OF THE GOVERNMENT LICENCE NO. 0015703

LEGEND

11. 580mmø I.D. OUTFALL PIPE FROM PROPOSED TREATMENT PLANT.

Rev.	Date	Description	by	ch'd	app
A	16.09.08	WW DISCHARGE LICENCE APPLICATION	RO'S	DS	RJB

Project
KINSALE MAIN DRAINAGE SCHEME
KINSALE, Co. CORK.

Title
LOCATION OF SITE NOTICE

Client
CORK COUNTY COUNCIL

Consultants / Project Managers
Malachy Walsh & Partners
JACOBS
Park House,
Mahon Tech. Park,
Blackrock, Cork,
Ireland.
Tel : +353 (0)21 4536400
Fax : +353 (0)21 4536450

Scales (A1)	1:5000	
Drawn	RO'S	16.09.08
Ch'd	DS	16.09.08
Ch'd(Eng.)	FOM	16.09.08
Approved	RJB	16.09.08

Project No. 765685-W
Drawing No. 0006
Rev. A

Attachment B.10

Cork County

Water Services Investment Programme 2007 - 2009

Schemes at Construction	W/S	Est. Cost
Cork North		
Mitchelstown Sewerage Scheme (Nutrient Removal)	S	221,000
Cork South		
Ballyvourney/ Ballymakeery Sewerage Scheme	S	3,049,000
Cobh/ Midleton/ Carrigtwohill Water Supply Scheme	W	10,135,000
Cork Lower Harbour Sewerage Scheme (Crosshaven SS) (G)	S	4,850,000
Cork Water Strategy Study (G)	W	941,000
Kinsale Sewerage Scheme	S	20,000,000
Midleton Sewerage Scheme (Infiltration Reduction) (G)	S	2,078,000
		41,274,000
Schemes to start 2007		
Cork North		
North Cork Grouped DBO Wastewater Treatment Plant (Buttevant, Doneraile & Kilbrin)	S	5,150,000
Cork West		
Skibbereen Sewerage Scheme	S	20,000,000
		25,150,000
Schemes to start 2008		
Cork North		
Mallow/ Ballyviniter Regional Water Supply Scheme (H)	W	8,662,000
Mallow Sewerage Scheme (H)	S	5,408,000
Cork South		
Ballincollig Sewerage Scheme (Nutrient Removal) (G)	S	948,000
Ballingeary Sewerage Scheme	S	1,296,000
Bandon Sewerage Scheme Stage 2	S	14,729,000
City Environs (CASP) Strategic Study (G)	S	153,000
Cloghroe Sewerage Scheme (Upgrade)	S	683,000
Coachford Water Supply Scheme	W	1,318,000
Garrettstown Sewerage Scheme	S	2,153,000
Inniscarra Water Treatment Plant Extension Phase 1	W	2,678,000
Little Island Sewerage Scheme (G)	S	2,200,000
Cork West		
Bantry Sewerage Scheme	S	7,148,000
Dunmanway Sewerage Scheme	S	2,153,000
Leap/ Baltimore Water Supply Scheme	W	6,365,000
Schull Water Supply Scheme	W	5,253,000
		61,137,000
Schemes to start 2009		
Cork North		
Banteer/Dromahane Regional Water Supply Scheme	W	1,576,000
Conna Regional Water Supply Scheme Extension	W	2,627,000
Cork NE Water Supply Scheme	W	4,326,000
Cork NW Regional Water Supply Scheme	W	6,046,000
Millstreet Wastewater Treatment Plant (Upgrade)	S	1,628,000
Cork South		
Ballincollig Sewerage Scheme (Upgrade) (G)	S	22,248,000
Cork Lower Harbour Sewerage Scheme (excl. Crosshaven SS)	S	73,542,000
Shannagarry/ Garryvoe/ Ballycotton Sewerage Scheme	S	3,780,000
Youghal Sewerage Scheme	S	14,420,000
Cork West		
Ballydehob Sewerage Scheme	S	683,000
Bantry Water Supply Scheme	W	14,935,000
Clonakilty Sewerage Scheme (Plant Capacity Increase)	S	3,677,000
Courtmacsherry/ Timoleague Sewerage Scheme	S	2,472,000
Dunmanway Regional Water Supply Scheme Stage 1	W	12,669,000
		164,629,000
Serviced Land Initiative		
Cork North		
Ballyclough Water Supply Scheme	W	139,000
Ballyhooley Improvement Scheme	W/S	139,000
Broghill Rathgoggin Sewerage Scheme	S	406,000
Bweeng Water Supply Scheme	W	115,000
Churchtown Sewerage Scheme (incl. Water)	W/S	543,000
Clondulane Sewage Treatment Plant	S	417,000
Freemount Sewerage Scheme	S	150,000
Pike Road Sewerage Scheme (incl. Water)	W/S	2,080,000
Rathcormac Sewerage Scheme (incl. Water)	W/S	555,000
Spa Glen Sewerage Scheme	S	736,000
Uplands Fermoy Sewerage Scheme (incl. Water)	W/S	1,174,000
Watergrasshill Water Supply Scheme (incl. Sewerage) (G)	W/S	4,151,000
Cork South		
Ballincollig Sewerage Scheme (Barry's Rd Foul and Storm Drainage) (G)	S	1,164,000
Belgooley, Water Supply Scheme (incl. Sewerage)	W/S	2,913,000
Blarney Water Supply Scheme (Ext. to Station Rd) (G)	W	416,000
Carrigtwohill Sewerage Scheme (Treatment and Storm Drain) (G)	S	7,632,000
Castlematyr Wastewater Treatment Plant Extension	S	1,200,000
Crookstown Sewerage Scheme (incl. Water)	W/S	1,200,000
Dripsey Water Supply Scheme (incl. Sewerage)	W/S	1,112,000
Glounthane Sewerage Scheme (G)	S	1,576,000
Innishannon Sewerage Scheme	S	277,000
Innishannon Wastewater Treatment Plant	S	694,000
Kerrypike Sewerage Scheme	S	832,000
Kerrypike Water Supply Scheme	W	416,000
Killeagh Wastewater Treatment Plant Extension	S	1,200,000
Killeagh Water Supply Scheme (includes Sewerage)	W/S	485,000
Killeens Sewerage Scheme	S	420,000
Kilnagleary Sewerage Scheme	S	694,000
Midleton Wastewater Treatment Plant Extension	S	4,050,000

Attachment B.12

FORESHORE LICENCE

CONV50

MEMORANDUM OF AGREEMENT made the day of , 2005 **BETWEEN THE MINISTER FOR COMMUNICATIONS, MARINE AND NATURAL RESOURCES,** of Leeson Lane, in the City of Dublin, (hereinafter called "the Minister" which expression shall include his Successors or Assigns where the contract so requires or admits),of the One Part and Cork County Council of County Hall, Cork (hereinafter called "the Licensee"),of the Other Part.

WHEREAS the Licensee has applied to the Minister for a Licence to use and occupy that part of the Foreshore described in the First Schedule hereto (hereinafter called "the Scheduled Property."), for the purpose as set out in the Second Schedule hereto (hereinafter called "the Development")

AND WHEREAS the Minister, in exercise of the powers vested in him by Section 3 of the Foreshore Act,1933, as amended by Section 2 of the Foreshore (Amendment) Act, 1992, hereby grants to the Licensee Licence to use and occupy the said Scheduled Property on the terms and conditions following:-

1. This Licence shall remain in force for the term of 35 years from the date hereof except as hereinafter provided.

2. The Licensee shall comply with the Site Specific requirements stipulated by the Minister as set out in the Third Schedule hereto.

3. The Licensee shall pay to the Minister the sum of €5,346.50 (five thousand three hundred and forty six Euro and fifty cent) on the execution hereof (receipt of which is hereby acknowledged) and the annual sum of €1 (one euro) if demanded and thereafter any additional sum that may be imposed as hereinafter provided, such payments to be made on the first day of in every year during the continuance of this Licence the first of such payments to be made on the signing hereof.

4. The Development shall be placed, maintained and constructed in accordance with the plans which have been submitted to, and approved by the Minister.

5. The Licensee shall use that part of the Scheduled Property, the subject matter of this Licence, for the purpose of said Development and for no other purpose thereof.

6. The Licensee shall, at all times during the continuance of this Licence, keep the said Development in a good and proper state of repair and condition to the satisfaction of the Minister and ensure that it will not be injurious to navigation, the adjacent lands or the public interest.

7. The Licensee shall indemnify and keep indemnified the State and the Minister, their Officers, Agents and Employees against all actions, loss, claims, damages, costs, expenses and demands, arising in any manner whatsoever in connection with the construction maintenance or use of the said Development or in the exercise of the permission hereby granted.

8. The Minister shall be at liberty at any time to terminate this Licence by giving to the Licensee twelve months notice in writing ending on any day, and upon determination of such notice, the Licence and permission hereby granted shall be deemed to be revoked and withdrawn without the liability for the payment of any compensation by the Minister to the Licensee.

9. The Licensee, shall, if so required by the Minister, within twelve months after receipt of such notice, or on determination of this Licence from any other cause, at its own expense remove the said Development to the satisfaction of the Minister, and, if the Licensee refuses or fails to do so, the Minister may cause the said Development to be removed and shall be entitled to be paid by and to recover from the Licensee as a civil debt due to the State all costs and expenses incurred by him in connection with such removal and restoration.

10. In the event of the breach, non-performance or non-observance by the Licensee of any of the conditions herein contained, the Minister may forthwith terminate this Licence without prior notice to the Licensee

11. Any notice to be given by the Minister may be transmitted through the Post Office addressed to the Licensee at its last known address

12. The benefit of this Licence is personal to the Licensee and not assignable and the rights given hereunder may only be exercised by the Licensee.

AND IT IS HEREBY CERTIFIED THAT:

1. For the purpose of the stamping of this Instrument that this is an Instrument to which the provisions of Section 53 of the Finance Act,1999, do not apply for the reason that the entire of the Scheduled Property involved comprises Foreshore and contain no Buildings.

2. The Family Law Acts of 1976, 1981, 1989, 1995 and the Family Law (Divorce) Act, 1996, do not affect the Property.

FIRST SCHEDULE

ALL THAT AND THOSE an area of foreshore at Kinsale in the County of Cork more particularly described and delineated in red on the map annexed hereto.

SECOND SCHEDULE

1. A thirty five year Foreshore Licence for the purpose of laying, using and maintaining storm discharges, emergency overflows, main crossing and outfall pipe at Kinsale, Co. Cork.

THIRD SCHEDULE

1. The Licensee shall use that part of the foreshore the subject matter of this Licence for the purpose of laying, constructing, using and maintaining the aforementioned storm discharges, emergency overflows, main crossing and outfall pipe (hereinafter referred to as the "works") as listed in the Schedule of Works below and in accordance with the detailed plans and drawings as submitted to, and approved by, the Minister for Communications, Marine and Natural Resources and for no other purpose whatsoever.

2. The Licensee may also use adjacent foreshore but only to the extent necessary for the purpose of laying, constructing, and maintaining the said works and shall restore the said foreshore to its proper condition immediately after such use.

3. The Licensee shall;

   i) prior to commencement of works on the foreshore, provide certification by a Chartered Engineer stating that the works have been designed in accordance with relevant Irish or British Standard Specifications or Codes of Practice for strength, stability and durability, taking into account current building regulations and safety legislation;

   ii) provide certification by a Chartered Engineer within two months after completion of the said works, that the works have been completed in accordance with the drawings*, approved of by the Minister for Communications, Marine and Natural Resources and with the said Specifications or Codes of Practice;

   iii) advise the British Admiralty Hydrographic Office, of the timing, location and nature of the proposed development;

   iv) arrange for the publication of a local marine notice in a locally read newspaper giving a general description of works and approximate dates of commencement and completion;

   v) apply to the Commissioners of Irish Lights for sanction of new aids to navigation and/or alteration of existing aids to navigation;

   vi) ensure that all diffusers are adequately marked.

(* Drawing Nos. 3505-0037 Rev B& 3505-0038 Rev B as submitted by Malachy Walsh & Partners)

4. The Licensee shall also;

i) ensure that a full archaeological assessment is carried out on all areas to be impacted by the works at the following locations: Denis Quay, Ballynacubby Beach and the intertidal zones at Kinsale Harbour, Bandon River and between Scilly Road and Pier Road. The assessment should include a desktop survey, an intertidal and underwater survey and a metal detection survey. All surveys should be licensed under the National Monuments Acts 1930-1994 and should be undertaken by a suitably qualified archaeologist. These surveys must be carried out before the commencement of any works.

ii) forward a report of all surveys as described in 4(i) above to the Heritage and Planning Division of the Department of the Environment, Heritage and Local Government (hereinafter referred to as the Heritage and Planning Division) for review and comply with any conditions that the Heritage and Planning Division may lawfully impose.

iii) ensure that all subsurface digging and topsoil removal below the high water mark in the town of Kinsale and its environs are monitored. All monitoring work shall be licensed under the National Monuments Acts 1930-1994 and shall be undertaken by a suitably qualified archaeologist.

iv) ensure that the Heritage and Planning Division are immediately informed should material of an archaeological nature be discovered and comply with all additional conditions that the Heritage and Planning Division may lawfully impose.

v) forward a report of the results of the archaeological monitoring to the Heritage and Planning Division for review.

5. The Licensee shall ensure that all works are carried out in accordance with applicable environmental laws.

6. The Licensee shall notify the Irish Coast Guard by telephone immediately at (01) 6782301 or (01) 6782302 in the event of any spillage or accident occurring below the high water mark of ordinary or medium tides or above the high water mark which may impact on the foreshore during the carrying out of the works, the subject of this licence, or during operations following the completion of these works.

7. The Licensee shall provide a level of treatment, including disinfection by ultraviolet treatment or an equivalent treatment system, which shall ensure the following effluent quality at the inspection chamber in the channel downstream of the treatment plant:

i) The geometric mean of faecal coliforms per 100ml of effluent shall be 250 fc or less. This limit may be reviewed in the event of variation of effluent inputs. Compliance with this clause shall be measured on the basis of a 50 sample rolling programme, as applicable.

ii) 95% of all samples shall be less than 1,000 fc/100ml of effluent. In the event of a result of over 1,000 fc/100 ml , the Licensee shall immediately contact the Department of Communications, Marine and Natural Resources to agree necessary corrective action

8. The effluent discharged from the treatment plant outfall pipe shall have a maximum 5-day B.O.D. concentration of 25 mg/l and a maximum suspended solids concentration of 35 mg/l, on a 95% basis. The maximum total daily BOD load discharged from the treatment plant outfall shall be 200 kg.

9 (i) Testing of the effluent from the wastewater treatment plant for faecal coliforms shall be on a weekly basis or as otherwise directed by the Minister. Testing for Small Round Structured Viruses (SRSV) in the effluent shall be agreed with the Minister before the scheme comes into operation.

(ii) A sampling programme to monitor effluent quality during storm overflows shall be agreed with the Minister before the scheme comes into operation.

(iii) The analyses shall be carried out in an accredited laboratory by an approved methodology.

(iv) The results of the analyses shall be submitted to Sea Fisheries Control Division of the Department of Communications, Marine and Natural Resources immediately on receipt.

(v) The cost of all the aforementioned sampling and monitoring shall be borne by the Licensee.

10. In the event of a viral health problem arising in the adjacent oyster production areas, the Licensee shall arrange for an independent study to be carried out at the request of the Licensor of the source of contamination and determine the contribution, if any, by the Kinsale Sewerage Scheme to the contamination. The standards laid down at 7(i) and (ii) above may be reviewed, as necessary, by the Minister with a view to addressing the health issues accordingly.

11. Should a standard viral classification system be laid down for molluscan production areas, the licence may be amended to take this into account.

12 The Licensee shall ensure that any breakdown of the effluent treatment system is notified immediately to the Sea Fisheries Control Division, Department of Communications, Marine and Natural Resources so that any problem can be contained.

13. All works shall be completed within five years of the granting of this Licence

14. The Licensee shall consult with the Area Engineer of the Department of Communications, Marine and Natural Resources during all stages of the works.

Schedule of Works

Number	Description	Drawing No.
1	1 no 525mm diameter storm discharge at Long Quay into the Scilly Dam. There will not be any foul connections to this pipe. The pipe will be fitted with a flap valve at the outlet.	3505-0037
3	1 no. 300mm storm discharge to replace a combined foul/storm untreated overflow at the Pier Road near the Town Park. There will not be any foul connections to this pipe. The pipe will be fitted with a flap valve at the outlet.	3505-0037
4	1 no. 300mm emergency overflow from Denis' Quay Pumping Station (PS 1) at Pier Road to replace the existing untreated overflow from the Pumping Station. The pipe will be fitted with a flap valve at the outlet. This discharge will only arise during electrical power cuts and will comprise diluted screened overflows from the storm retention tanks.	3505-0037
5	1 no. 150mm emergency overflow (screened) from Pumping Station 2 at the Summercove to replace the existing untreated combined foul/storm discharge. The maximum flow arriving at the pumping station for a 5-year storm is equivalent to 10.5 DWF. The overflow setting for the pumps is set at 10.5 DWF. The pipe will be fitted with a flap valve at the outlet. Overflows may also occur due to electrical power failure.	3505-0037
6	1 no. 150mm emergency overflow (screened) from Pumping Station 3 at Scilly Walk. The maximum flow arriving at the pumping station for a 5-year storm is equivalent to 22 DWF. The overflow setting for the pumps is set at 12 DWF. The pipe will be fitted with a flap valve at the outlet. Overflows may also occur due to electrical power failure.	3505-0037
7	1 no. 150mm emergency overflow (screened) from Pumping Station 4 at Scilly to replace miscellaneous untreated point discharges in the area. The maximum flow arriving at the pumping station for a 5-year storm is equivalent to 6 DWF. The overflow setting for the pumps is set at 6 DWF. The pipe will be fitted with a flap valve at the outlet. Overflows may also occur due to electrical power failure.	3505-0037
8	A 225mm diameter pumped main crossing from Scilly to Pier Road to convey foul sewerage from Scilly/Summercove areas to Pumping Station 1. There will be no discharge from this pipe.	3505-0037

9	1 no. 150mm emergency overflow (screened) from Pumping Station 5 at World's End to replace the existing untreated comminutor discharge. The maximum flow arriving at the pumping station for a 5-year storm is equivalent to 6 DWF. The overflow setting for the pumps is set at 6 DWF. The pipe will be fitted with a flap valve at the outlet. Overflows may also occur due to electrical power failure.	3505-0037
10	1 no. 700mm storm discharge at Gibbon's Quay. This will also serve as the discharge point from the storm overflow pumps at Denis' Quay Pumping Station (PS 1). These pumps will only operate when the capacity of the storm retention tank is beaten. All flows will be screened to 6mm and will be considerably diluted. The pipe will be fitted with a flap valve at the outlet.	3505-0037
11	A 560mm diameter outfall pipe from the proposed treatment plant, complete with 6 no. port diffusers, to discharge the treated effluent in the centre of the estuary between the old and new Western Bridges. Occasionally, overflow discharges from the storm holding tank will also be discharged. These overflow discharges will be screened to 6mm prior to discharge.	3505-0038

IN WITNESS whereof the Licensor has caused his seal of Office to be hereunto affixed and the Common Seal of the Licensee has been affixed hereto the day and year first above **WRITTEN.**

PRESENT when the Seal of
Office of the **MINISTER FOR THE COMMUNICATIONS, MARINE, AND NATURAL RESOURCES,** was affixed and
was authenticated by the
signature of:

_____

_____

A person authorised under Section 15(1) of the Ministers and Secretaries Act, 1924, to authenticate the seal of the Minister

WITNESS: _____

ADDRESS: _____

_____

OCCUPATION: _____

PRESENT when the Common Seal)
)
of the Licensee was affixed)
)
hereto:)
)
)
)
)
)
)
)

Dated this day of 2005

THE MINISTER FOR COMMUNICATIONS, MARINE AND NATURAL RESOURCES

One part

-WITH-

CORK COUNTY COUNCIL

Second Part

FORESHORE LICENCE

DAVID J. O'HAGAN
CHIEF STATE SOLICITOR,
OSMOND HOUSE,
LITTLE SHIP STREET,
DUBLIN 8.

File Ref: Kinsale Sewerage Scheme Licence
AKC 1545/2005

Attachment C.1

KINSALE MAIN DRAINAGE SCHEME
WASTEWATER TREATMENT PLANT AND OUTFALL

DOCUMENT TITLE: **Volume 4: Employer's Requirements Part A – Design Build Works**

DOCUMENT No: **76-5685-76/T.02A/0004/G**

MODULE: **Wastewater Treatment Plant & Outfall** ☒

Network & Pump Stations ☐

PROJECT NUMBER: **3505 / 76 5685 00**

Client: **Cork County Council**

Project Location: **Kinsale, County Cork**

Project Manager Authorisation: **Date:**

Client Authorisation: **Date:**

			APPROVALS		
Rev	**Date**	**Issue Description**	**By**	**Check**	**Approve**
A	25.09.2003	Issued for Client Approval	RJB	TH	RJB
B	05.12.2003	Issued for DEHLG Approval			
C	31.08.2006	Updated prior to resubmission to Client	RJB		
D	11.12.2006	Submission for Final Client Review	RJB	MJOS	RJB
E	28.01.2007	Submission for DEHLG Review	RJB	MJOS	RJB
F	12.08.2007	Updated following DEHLG Review	RJB	MJOS	RJB
G	22.11.2007	Updated following DEHLG Review 26.10.2007	RJB	MJOS	RJB

☒	Entire Specification Issued this Revision	SPECIFICATION ISSUED FOR:			
		☐	In-house Review	☐	Purchase
☐	Revised Pages Only Issued this Revision	☐	Client Approval	☐	Construction
		☐	Enquiry	☒	Tender

CORK COUNTY COUNCIL

KINSALE MAIN DRAINAGE SCHEME
WASTEWATER TREATMENT PLANT & OUTFALL

Employer's Requirements Part A - Design Build Works

EMPLOYER'S REQUIREMENTS PART A - DESIGN BUILD WORKS

Table of Contents

TABLES

FIGURES

EMPLOYER'S REQUIREMENTS PART A - DESIGN BUILD WORKS

1.0 TENDER DOCUMENTS

The tender documents comprise:-

1. A bound document containing Volume 1 - Instructions to Tenderers
2. A bound document containing Volume 2 - Conditions of Contract Part II (A), Design - Build Works and Volume 3 - Conditions of Contract Part II (B) Operation and Maintenance Works.
3. A bound document containing Volume 4 - Employer's Requirements Part A – Design-Build Works and Volume 5 - Employer's Requirements Part B – Operation and Maintenance Works which contain a Description of the Works, Performance Requirements, Design Criteria, and Testing and Taking Over of the Works.
4. A bound document containing Volume 6 – Tender and Payments
5. A bound document containing Volume 7 – Contract Forms
6. A bound document containing Volume 8 - General Civil Engineering Specification
7. A bound document containing Volume 9 - General Electrical Engineering Specification.
8. A bound document containing Volume 10 - General Mechanical Engineering Specification.
9. A bound document containing Volume 11 – Preliminary Health and Safety Plan
10. Volume 12 - Ground Investigation Factual Report.
11. Volume 13 - Environmental Impact Statement, Kinsale Wastewater Treatment Works, Foreshore Licence
12. Volume 14 – Performance Management System (Volume 1 - Waste Water Treatment Plants)
13. Drawings

2.0 SCOPE OF WORKS

2.1 BACKGROUND

Kinsale is one of the most important and popular tourist destinations in the Southern Region, and is located some 16 kilometres west of Cork City.

The resident population of the town and its environs (as enumerated in the April 2006 Census) was 4099, and this is supplemented by considerable numbers of visitors, particularly during the summer season (June, July and August). Lesser, but still significant numbers of visitors visit at other times of the year. Peak visitor numbers are usually associated with fine weekends, particularly when associated with one of the many events staged in the town throughout the year.

There are a small number of industries in the town at present, the most significant of which are located in the town's industrial estate.

2.2 EXISTING FACILITIES

The existing collection system was constructed in the mid to late 1970's, when the system of sewers and culverts which existed at that time was supplemented by additional sewers together with the installation of a pumping station at Denis' Quay. The existing collection system is totally combined which means that, if flooding occurs in the town, foul sewage may emanate from manholes and gullies.

In general all sewers gravitate towards the central flat part of the town in the vicinity of Church Square, Market Square and Pearse Street. Two culverts discharge to the Scilly Dam area. The Pearse Street Culvert carries flows from the New Road area through the Glen and along Pearse Street while the Market Quay Culvert takes the foul sewage and stormwater from the Market Street Area.

Foul sewage from the lower part of the town and the Lower O'Connell Street area is conveyed to the pumping station at Denis' Quay. The flows are comminuted before discharge to the harbour at World's End.

There are currently five storm overflows in operation together with a number of discreet foul discharges.

There are no treatment facilities in Kinsale at present.

2.3 UPGRADED COLLECTION SYSTEM

The foul sewage from Kinsale Town, Scilly and Summercove will be collected in a system of existing and new sewers and conveyed to a new main pumping station to be constructed on the site of the existing pumping station at Denis' Quay.

While the wastewater from the Scilly and Summercove areas will be pumped, the balance will flow by gravity to the main pumping station, and be pumped from there to Commoge and by gravity to the wastewater treatment plant site at Cappagh.

Stormwater in the higher parts of the town will be collected in a series of new storm sewers and discharge under pressure into the Scilly Dam while the lower area will be served by a new system incorporating some storage to provide against flooding during periods of high water. Run-off from roofs and roads will continue to discharge directly to the harbour.

Where necessary existing sewers, which will form part of the new system will be rehabilitated, repaired or replaced to ensure that infiltration is minimised.

2.4 GENERAL DESCRIPTION OF THE WORKS

1. The Contractor shall design, construct, test, commission, operate and maintain the Works, i.e. Kinsale Wastewater Treatment Plant, on a Design Build and Operate basis as described in the Contract, on the basis of the design values and criteria indicated in Clause 3.0 of this document.

2. A short section of the Outfall Pipe has been constructed under an Advance Contract and the Contractor shall take over full responsibility for the operation and maintenance of this element.

3. The Contractor shall define the process and determine the individual process units to achieve the performance criteria stated in the Employer's Requirements. The detailed design shall be based on the units presented in the Contractor's Proposal and/or as modified or amended under the Contract. The Contractor shall be responsible for ensuring the compatibility of the individual process units with one another.

4. It is expected that the selected treatment process will generally comprise preliminary treatment (coarse and fine screening, grit and grease removal) primary sedimentation (if necessary) and biological secondary treatment process including sludge thickening facilities and sludge dewatering. The final effluent with a concentration of less than 20 mg/l BOD_5 and 30 mg/l SS will be discharged to the proposed new outfall. The sludge, dewatered to a dry solids concentration of not less than 20%, will be disposed by the Employer off-site.

5. Odour shall be controlled by biological or chemical treatment to such an extent that 95 and 98 percentile of odour concentrations are less than 1 and 2 OU/m^3 respectively above background levels at the boundary of the site and that the hydrogen sulphide concentration at the exhaust stacks of the odour control units shall not exceed 2 ppb and

at any one of the four measuring points at the boundary of the treatment plant site does not exceed 0.5 ppb H_2S as H_2S.

6. The works shall be designed to ensure that the Works complies in all respects with the requirements of the relevant provisions of the Safety, Health and Welfare at Work (Control of Noise at Work) Regulations 2006 and European Communities (Wastewater Treatment) (Prevention of Odour and Noise Regulations (S.I. 787 of 2005) and shall further ensure that the following noise levels are not exceeded during the operation of the plant, when measured at the boundary of the treatment plant site:

Day:	08.00 hrs to 20.00 hrs	50 dB (A) 30 minute Leq
Night:	20.00 hrs to 08.00 hrs	40 dB (A) 30 minute Leq

7. The Criteria for Evaluation of Tenderer's Proposals are listed in Volume 1: Instructions to Tenderers – Instruction 2.30.

8. To facilitate a full understanding and evaluation of the process design the Contractor is required to submit a Mass Balance of the complete wastewater, sludge and air treatment flows including all return flows. The mass balance should be presented in the form of a linear schematic process flow diagram and shall quantify for each process stage (as appropriate) the following:

- Flow
- BOD
- COD
- Suspended Solids
- FOG Removed
- Screenings & Grit Removed
- Nitrogen
- Phosphorus
- Disinfection
- Sludge Generation
- Dewatered Sludge Quantities

9. The mass balance shall show and take full account of all chemicals used.

10. The mass balance calculation shall be carried out and shown under DWF, Peak Flow, Storm Overflow Conditions, and Maximum Flow.

11. A balance shall also be submitted to show the anticipated odour emissions (after treatment) for each process area.

12. If the criteria described in the Employer's Requirements and as offered in the Contractor's Tender, and/or as modified or amended under the Contract, are not maintained after commissioning of the Works, the Contractor will suffer price adjustments as indicated in Volume 6: Tender and Payments – Section 5.2.3.

2.5 GENERAL REQUIREMENTS REGARDING THE WORKS

1. The Contractor shall design the wastewater treatment plant and outfall to be constructed at the site at Cappagh, Kinsale, County Cork, designated for this purpose, in such a way as to limit adverse impacts on the receiving waters and the public living and working nearby.

2. The Environmental Impact Statement for the Wastewater Treatment Plant and Outfall was published in February 1999 and was subsequently certified by the Minister for the Environment and Local Government in September 1999. A copy of the EIS and the Minister's certification is included in Volume 13. The Contractor's proposal shall in all

respects comply with the boundary conditions set down in the Certified EIS and the Minister's certification.

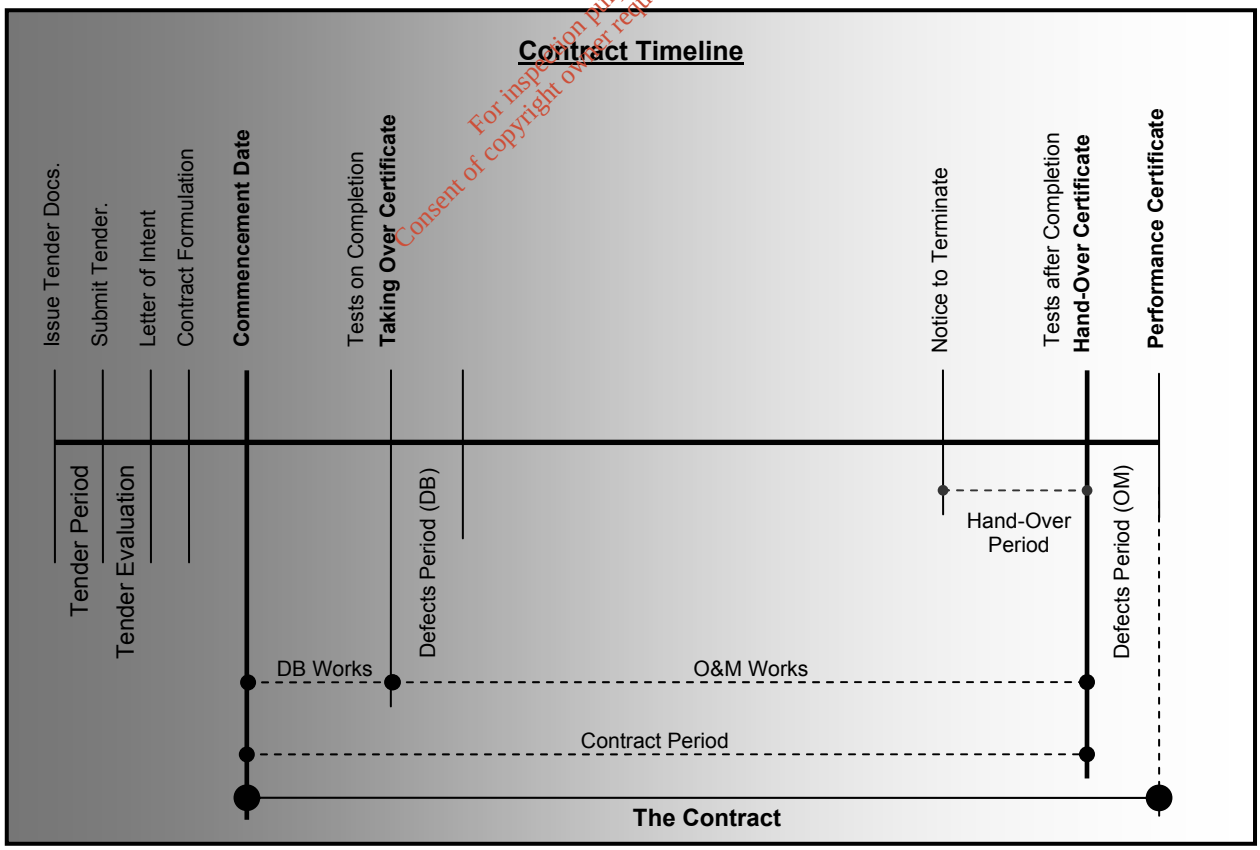
3. Where boundary conditions as set out in the Employer's Requirements Part A or Part B are more stringent than those set out in the EIS as certified by the Minister, these shall be complied with.

4. The final appearance of the Works shall be as outlined in the Contractor's Proposal and/or as modified or amended under the Contract. In particular, the following points shall be taken into account in the design:

- A plot of land as indicated on the drawing attached has been designated for the construction of the wastewater treatment plant.
- Odour and noise emission boundary conditions shall be complied with to minimise nuisance to the public who live and work nearby.
- The landscaping and/or architectural design of the treatment plant shall be such as to reduce its visual impact and shall take account of adjacent land uses.
- Discharge of the treated wastewater shall be by gravity via the existing/proposed new outfall. Arrangements shall also be made for the emergency discharge of wastewater after preliminary treatment, by gravity.
- Biological sludge (following sludge dewatering) from the wastewater treatment plant shall be disposed by the Employer.

2.6 MAIN DIVISIONS AND TIME FRAME OF THE WORKS

1. The Contract Timeline is shown below:



2. At the end of the design works, the Contractor shall have submitted all necessary documents to the Employer's Representative for review and confirmation of compliance with the Employer's Requirements issued.

3. At the end of the construction works, the Contractor shall have completed and shall have set to work, tested and commissioned all parts of the Works, shall have successfully completed the Tests on Completion and shall have obtained the Taking Over Certificate.

4. During the Defects Liability Period, which will last for one year, the Contractor shall complete any outstanding work and shall remedy all defects.

5. The Operation and Maintenance Period shall also start after the Contractor has received the Taking Over Certificate and shall last for 20 years or such lesser period as may be provided for under the Contract. During the Operation and Maintenance Period, the Contractor shall operate and maintain the Works in such a way, that the agreed performance is achieved at all times.

6. The Contractor shall carry out the Tests after Completion (in the following partly referred to as Performance Tests), proving that the Works achieve the specified performance criteria and the agreed consumption values.

7. The training of Local Authority Staff shall be accomplished and successfully completed by the Contractor within the first year of the above mentioned Operation and Maintenance Period, with final staff training being provided immediately after the Test after Completion.

8. A tentative work programme indicating the various dates and periods for the realisation of the Works as stated in the Tender Documents and/or as estimated for the purpose of implementation, including the anticipated cashflow must be included with the tender.

9. It is the intention of the Employer to award the works for the Kinsale Main Drainage Scheme - Wastewater Treatment Plant and Outfall in one separate package as follows:

   - Design, construction, supply, installation, testing and commissioning of equipment and Plant incl. supply of spare parts, and operation, maintenance and staff training for twenty years.

2.7 EXTENT OF THE WORKS

The Works shall include, but shall not be limited to:

1. Surveys and investigations for the purpose of design:

   - interpretation and verification of existing data given in the Employer's Requirements,
   - survey and investigations to locate existing utilities
   - other necessary site investigations

2. Design of the Works including but not being limited to the wastewater and sludge treatment process as well as:

   - connection to existing sewerage system at the boundary of the site (or at the closest manholes)
   - treated wastewater discharge to the outfall
   - internal pumping stations,
   - buildings and structures,
   - ancillary works and equipment,
   - residuals (screenings and grit, FOG) disposal by the Contractor
   - disinfection of the final effluent
   - treated water outfall
   - a design layout of the WWTP shall be provided showing how the works can be extended to cater for a design population equivalent of 15 000
   - a further design layout of the WWTP shall be provided showing how the plant can be expanded to cater for the present design loading of 10 000 population equivalent and

to meet a total nitrogen discharge standard of 15 mg/l and a total phosphorus discharge standard of 2 mg/l expressed as an annual mean

- Biological sludge shall be dewatered and transported by the Contractor to a site to be designated (by the Employer) not more than 50 km from the WWTP Site for disposal by the Employer.

3. Carrying out the duties of Project Supervisor Design Process in accordance with Safety, Health and Welfare at Work (Construction) Regulations, 2006, S.I 504 if so appointed by the Employer

4. Construction of the Works as defined by the designed process including all sub-structures, structures, buildings, mechanical and electrical works, internal roads, access road, landscaping, site works and fencing, and the provision of services, facilities and equipment.

5. Carrying out the duties of Project Supervisor Construction Stage in accordance with Safety, Health and Welfare at Work (Construction) Regulations, 2006, S.I 504 if so appointed by the Employer

6. Manufacture, testing at places of manufacture, painting, packing, supply, delivery, erection and painting after erection of all equipment and Plant.

7. Location, diversion and relocation of existing utilities and services, as required.

8. Connection to existing sewerage systems at the limit of the WWTP site or at the closest manhole(s)

9. Construction of a new outfall to the estuary of the River Bandon. It should be noted that part of the land based outfall has been constructed under an Advanced Contract, details of which are shown on Drawing 3505_1190.

10. Start-up of operation, commissioning and testing:

    - setting to work of all Plant and treatment processes, laboratories, workshops and other installations,
    - commissioning,
    - site testing,
    - preparation of As-Built Drawings and records as well as operation, maintenance and safety manuals,
    - acceptance testing as Tests on Completion and Performance Tests to prove the suitability of the Works for the intended use and compliance with the defined standards and criteria as well as with the guaranteed duties, performance and consumption values.

11. Remedying any defects during the Defects Liability Period.

12. Operation and Maintenance:

    - setting up and operation of a preventive maintenance system,
    - operation and maintenance period will extend for 20 years or such lesser period as allowed under the contract
    - monitoring, control and reporting
    - provision of vehicles(where required), spare parts, chemicals, lubricants, fuel and consumables,

11. Training of designated staff from the Employer to operate, maintain, monitor and control all aspects of the wastewater treatment plant.

2.8 COMPONENTS OF THE WORKS

1. The Works shall comprise all structures, units, systems, facilities, equipment and Plant necessary to fulfil the requirements of the Contract to comply with the Employers Requirements and as outlined in the Contractor's Proposal and/or as modified or

amended under the Contract. It is envisaged that they will include, but need not be limited to the following:

- preparation of site,
- connection to inlet sewer,
- inlet pumping
- screens, screen cleaning, screenings transfer, treatment and storage facilities,
- grit removal and cleaning, grease removal and separation, grit and grease storage and transfer facilities,
- flow measurement system,
- preliminary mechanical and/or physical wastewater treatment units,
- stormwater treatment and disposal
- biological wastewater treatment units,
- construction of new sea outfall
- connection to new sea outfall,
- emergency overflows and discharge structures and pipelines after grit removal mechanical treatment and after preliminary treatment
- internal pumping stations as required,
- sludge thickening units,
- sludge dewatering units,
- sludge and supernatant transfer systems,
- sludge handling and storage facilities (sufficient storage capacities to allow for minimum 4 days interruption of sludge transport),
- UV disinfection system,
- sludge dewatering facilities
- odour control (abatement) systems,
- chemical storage (for one month supply of locally available materials and six months of materials not locally available) and handling facilities,
- process and service pipeline systems,
- fire fighting system,
- internal water supply and sewerage system,
- automatic and manual sampling facilities,
- mechanical works,
- electrical works,
- connection to the public electricity supply line at the Site,
- transformer station, switchgear rooms,
- local control stations,
- electrical power distribution, lighting and telecommunication equipment,
- stand-by power generation equipment,
- instrumentation and control equipment including distributed PLC-systems,
- SCADA system including workstations and mimic panel,
- spare parts,
- any special equipment required for operation and maintenance
- safety equipment,
- workshops and workshop equipment,
- laboratory and laboratory equipment,
- administration building and equipment,
- landscaping and site works
- fencing
- internal roads, parking areas and lighting system,
- access road

2. The operation conditions “repair” and “inspection” shall be considered in the design and construction for all units and components of the Works, including:

- isolation of individual units from operation,
- emptying and drainage of individual units,

- accessibility (ladders, platforms, walkways),
- prevention of flotation of emptied units

2.9 PROVISIONAL SUMS

1. Provisional Sums have been included in the Contract of the amounts as stated in Volume 6 – Tender and Payments.

2. It is to be clearly understood that the Provisional Sums shall only be used, in whole or in part, in accordance with the Employer's Representative's instructions and only after the Employer's Representative has obtained the specific approval of the Employer before taking any action thereon.

3. Provisional Sums included in the Tender Price will not form part of the Contractor's Fixed Price Tender Sum and the Contractor shall have no claim or entitlement to any payment in respect of any Provisional Sum which is unspent.

4. The existence of the Provisional Sums does in no way entitle the Contractor to any claim and/or additional payment for fulfilling his obligations described in the Contract.

3.0 DESIGN BASIS

3.1 POPULATION FIGURES, WASTEWATER FLOWS AND OTHER DESIGN CRITERIA

The actual design population equivalent for the entire Kinsale Main Drainage Scheme is 9 800. The breakdown of the future load in the catchment has been estimated in Table 1 below.

Category	Population Equivalent
Current Domestic	3 390
Future Domestic	2 624
Total Design Domestic	**6 014**
Current Non-Domestic	3 316
Future Non-Domestic	470
Total Design Non-Domestic	**3 786**
TOTAL DESIGN P.E.	**9 800**

Table 1: Total Design Population Equivalent

3.2 DRAINAGE AREAS

The design population of 9800 is derived from the current and future requirements of the catchment. For convenience the catchment has been divided into three (3) drainage areas as shown on Drawing 3505 0025 Rev A.

3.2.1 Drainage Area A

The breakdown of the loads in Drainage Area A is given in Table 2 below.

Category	Population Equivalent
Current Domestic	1 169
Future Domestic	250
Total Design Domestic	**1 419**
Current Non-Domestic	693
Future Non-Domestic	0
Total Design Non-Domestic	**693**
Total Design P.E. for Area A	**2 112**

Table 2: Population Equivalents - Drainage Area A

3.2.2 Drainage Area B

The breakdown of the loads in Drainage Area B is given in Table 3 below.

Category	Population Equivalent
Current Domestic	2 041
Future Domestic	974
Total Design Domestic	**3 015**

Category	Population Equivalent
Current Non-Domestic	2 540
Future Non-Domestic	470
Total Design Non-Domestic	**3 010**
Total Design P.E. for Area B	**6 025**

Table 3: Population Equivalents - Drainage Area B

3.2.3 Drainage Area C

The breakdown of the loads in Drainage Area C is given in Table 4 below.

Category	Population Equivalent
Current Domestic	180
Future Domestic	1 400
Total Design Domestic	**1 580**
Current Non-Domestic	83
Future Non-Domestic	0
Total Design Non-Domestic	**83**
Total Design P.E. for Area C	**1 663**

Table 4: Population Equivalents - Drainage Area C

The wastewater from Drainage Areas A and B will be collected at a new pumping station to be constructed at Denis' Quay. The rising main will terminate at Manhole F397 (see Drawing 3505 1025). Flows from Drainage Area C will be collected and delivered to Manhole F397.

Flows from Drainage Area C will be collected and delivered to Manhole F397. From Manhole F397, the combined flows will be conveyed to Manhole F400 adjacent to the Wastewater Treatment Plant Site. The combined flows will be pumped from a new Inlet Pumping Station to the WWTP Inlet Works.

The Denis' Quay Pumping Station, pumps and the rising main from Denis' Quay will be installed under a separate contract and do not form part of the Design Build Operate Works. The 750 mm connection from Manhole F397 to Manhole F400 will also be installed under this separate contract. The DBO Contractor will be responsible for the connection from Manhole F400

3.3 DESIGN PARAMETERS FOR THE WASTEWATER TREATMENT PLANT

The new wastewater treatment plant (and its components) shall be designed based on the flows and loads shown in Table 5: Wastewater Treatment Plant – Design Flows and Organic Loads.

Parameter		Design
Average Flow Rate (DWF)	m^3/d m^3/h	3 000 125
Peak Flow to Inlet Works	l/s m^3/h	253 909
Peak Flow to Treatment (3 DWF)	l/s m^3/h	104 375
Biological Oxygen Demand BOD_5	kg/d	750
Chemical Oxygen Demand	kg/d	1500
Fats, Oil and Grease	kg/d	150
Suspended Solids	kg/d	1500

Table 5: Wastewater Treatment Plant – Design Flows and Organic Loads

3.3.1 Average Characteristics of the Wastewater

For the design of the WWTP the average characteristics of the wastewater shall be assumed to be

Parameter	Unit	Value
BOD_5	mg/l	250
COD	mg/l	500
Total Suspended Solids	mg/l	500
Fats, Oils and Grease	mg/l	50
pH		6.0 – 8.5
Temperature	^0C	< 30
Salinity	mg/l	< 400

Table 6: Characteristics of Untreated Wastewater

It is assumed that no noteworthy toxic or hazardous substances are present in the wastewater.

3.3.2 Treated Wastewater Quality

The following treated wastewater criteria shall apply:

Parameter	Value
BOD_5	$\leq$ 20 mg/l
COD	$\leq$ 125 mg/l
Total Suspended Solids	$\leq$ 30 mg/l
pH	6.0 – 8.5
Temperature	< 30^0C

Table 7: Treated Wastewater Criteria

In addition, In accordance with the Approved Environmental Impact Assessment, the total Nitrogen concentration in the final effluent shall be reduced to 15 mg/l or shall as a minimum be reduced by "70 – 80%".

The treated effluent shall also comply with the Foreshore Licence issued by the Department of Communications Marine and Natural Resources and in particular with the following:

- ✓ The geometric mean of faecal coliform per 100ml shall be 250 faecal coliform or less on the basis of a 50 sample rolling programme and
- ✓ 95% of all samples shall be less than 1000 faecal coliform /100ml of effluent

3.3.3 Sludge Quality

Sludge arising from the treatment processes shall be thickened and dewatered to comply with the criteria in Table 8: Sludge .

Parameter	Value
% Dry Solids of the Treated Sludge	> 20%

Table 8: Sludge Quality

3.3.4 Odour Control

Odour will be controlled by biological or chemical treatment to such an extent that 95 and 98 percentile concentrations of odour are less than 1 and 2 OU/m^3 respectively above background levels at the boundary of the site, as measured in accordance with IS EN 13725:2003 Air Quality – Determination of Odour Concentration by Dynamic Olfactometry and that the hydrogen sulphide concentration at the exhaust stacks of the odour control units shall not exceed 2 ppb and at any one of the four measuring points at the boundary of the treatment plant site does not exceed 0.5 ppb H_2S measured as H_2S.

3.3.5 Noise Control

The works shall be designed to ensure that that the following noise levels are not exceeded during the operation of the plant, when measured at the boundary of the treatment plant site:

Day:	08.00 hrs to 20.00 hrs	50 dB (A) 30 minute Leq
Night:	20.00 hrs to 08.00 hrs	40 dB (A) 30 minute Leq

3.3.6 Other Criteria

All other criteria and maximum concentrations are as mentioned elsewhere in these documents

3.4 CONTRACTOR'S PROCESS DESIGN

1. The Contractor shall define the process and determine the individual process units to achieve the performance criteria stated in the Employer's Requirements. The detailed design shall be based on the units presented in the Contractor's Proposal and/or as modified or amended under the Contract.
2. The Contractor shall ensure the compatibility of the individual process units with one another and shall fully demonstrate this by the provision of a detailed design report and the submission of detailed process calculations.
3. The Employer will however choose the Contractor whose tender proposes a turnkey solution, which complies with the Employer's Requirements and is the most economically advantageous tender. The evaluation, which is described in the Volume 1: Instructions to

Tenderers – Instruction 2.30, will take account of the listed Financial and Technical award criteria.

3.4.1 Modularity of Plant Design

The Contractor's Design shall be based on a modular format so that future extensions or modifications can be incorporated without undue disturbance to the Operation and Maintenance of the Wastewater Treatment Plant.

The Contractor shall ensure that pipework, inlet channels, splitter chambers, machinery and administration buildings, sludge treatment and storage facilities are designed to cater for a population equivalent of 15 000 and that the treated effluent outfall is designed to cater for a population equivalent of 20 000.

3.4.2 Proven Technology

The Contractor shall only propose technology, treatment processes, plant and equipment that

- Has been in satisfactory and consistent use for at least three (3) years on similar municipal wastewater treatment plants to that proposed and in similar operating and climatic conditions to Kinsale
- Are modern and up to date without entailing excessive capital or operating cost

3.4.3 Operational Flexibility

Operational flexibility is paramount and the Contractor shall ensure (where practicable)

- The provision of standby equipment and facilities
- The provision of by-passes to ensure plant operation is maintained during maintenance and plant breakdown
- Standardization and interchangeability of equipment

3.4.4 Standby Capacity

The Contractor shall ensure that sufficient standby capacity is provided to ensure that operation of the wastewater treatment plant can be maintained in the event of planned maintenance or breakdown.

3.4.5 Access and Space for Maintenance

The Contractor shall ensure in his design that sufficient space and safe access is provided around plant and equipment to ensure that operational tasks and maintenance can be carried out safely and efficiently.

Where necessary or desirable, dedicated lifting equipment shall be provided.

3.5 ENVIRONMENTAL IMPACT STATEMENT

A copy of the Environmental Impact Statement, Addendum to the Environmental Impact Assessment and Ministerial Approval of the Environmental Impact for the Kinsale Main Drainage Scheme – Treatment Plant and Outfall has been provided in Volume 12 and the Contractor is responsible for ensuring that his proposals shall comply fully.

3.6 IMPACT OF ACCESS ROADS / ENTRANCES

1. The impact of access roads, the entrance, vehicle parking and turning is potentially considerable and the Contractor's design must seek to minimise the impact of these.
2. Car parking for four vehicles during normal operation shall be provided. Additional areas for further parking shall be provided as an overspill area. These should be disguised using grasscrete (or equivalent), as large areas of tarmac are not acceptable.

3.7 IMPACT OF CONSTRUCTION

1. Access, circulation and storage areas provided during the contract, shall where possible, utilise final required service routes and storage areas. All temporary routes shall be removed and reinstated on completion of the works.
2. Solutions which minimise transportation of excavation materials off site will be favoured.

3.8 EMERGENCY PLAN

1. The Contractor shall prepare and submit an Emergency Plan for the works. The Emergency Plan drawings, and the signage within the works, shall clearly indicate all access/egress points, fire doors, fire fighting equipment and the zones indicated on the alarm systems.
2. The Emergency Plan shall include the details of how to deal with the various emergencies that could arise. The emergencies shall be considered and raised through a HAZOP study.
3. A 'Major Incident' involving scenarios from the emergency plan shall be enacted and monitored to test the plan response times and human factors/interfaces and intervention. A human factors specialist may be engaged by the Employer to monitor and report on the 'Major Incident'.
4. A common zone labelling system for gas, fire and intruder alarms shall be provided. COSHH sheets for chemicals contained within each zone shall be included within the Emergency Plan in addition to being prominently displayed at the entrance to the site and adjacent to each area where chemicals are stored or used.
5. The emergency plan shall be provided at least 2 months prior to the commencement of the commissioning period for comment and approval. The Certificate of Commissioning Completion is not issued by the Employer until the Emergency Plan has been accepted.
6. Sufficient emergency access and egress points shall be provided around the new works. The escape corridors and routes shall be clearly marked and approved by the Fire Officer and the Employer's Health and Safety Officer.
7. Access/egress points and any escape corridors shall facilitate the carrying of a stretcher. Ladders are not acceptable on escape routes.
8. Emergency exits shall be located with a maximum travel distance of 18m for the main accommodation areas where a single direction means of escape is provided. All other exits shall be located with a maximum travel distance of 45m from any point within the process areas.

3.9 SIGNS

1. The Contractor shall provide all signs at the new works. Signs include but are not limited to function area signs, zone labels, sample point labels, delivery area signs, emergency signs etc.
2. Two granite polished stones shall be provided by the Contractor at each entrance. The inscription and location shall be agreed with the Employer's Representative.

3.10 ARCHAEOLOGICAL HERITAGE

1. The Employer will appoint an archaeologist to maintain a watching brief during topsoil stripping and excavation and to provide advice in the event of an archaeological find. The Contractor shall co-operate with and assist the archaeologist in these duties.
2. The Contractor shall programme his activities to permit a minimum period of three weeks between topsoil strip and construction activities to allow archaeological clearance.

3. The Contractor shall provide any information, which is requested by the archaeologist and comply with any requirements to allow for archaeological surveys or inspections to be carried out.

3.11 ENVIRONMENTAL LIAISON OFFICER

1. The Employer will appoint an Environmental Liaison Officer who acts on behalf of the Employer in matters of any environmental impact in providing the Works.
2. The Contractor shall co-operate with and assist the Environmental Liaison Officer in these duties. The Contractor shall provide any information, which is requested by the Environmental Liaison Officer.

4.0 CONTRACTOR'S OBLIGATIONS

4.1 SAFETY, HEALTH AND WELFARE AT WORK ACT 2005 AND SAFETY, HEALTH AND WELFARE AT WORK (CONSTRUCTION) REGULATIONS 2006

The Contractor shall [without limiting other obligations] ensure, so far as is reasonably practicable that the Works:

(1) are designed and are capable of being constructed to be safe and without risk to health and
(2) are constructed to be safe and without risk to health and
(3) can be maintained safely and without risk to health during use and
(4) comply in all respects, as appropriate, with the relevant statutory provisions

The Contractor represents and warrants to the Employer that the Contractor is, and will, while performing the Contract, be a competent person for the purpose of ensuring, so far as is reasonably practicable, that the Works:

(1) are designed and are capable of being constructed to be safe and without risk to health and
(2) are constructed to be safe and without risk to health and
(3) can be maintained safely and without risk to health during use and
(4) comply in all respects, as appropriate, with the relevant statutory provisions

The Contractor represents and warrants to the Employer that the Contractor is and will, while performing the Contract, be a competent person to carry out the Works and has allocated and will allocate sufficient resources to enable itself to comply with the requirements and prohibitions imposed on the Contractor by or under the relevant statutory provisions.

The terms **competent person**, **reasonably practicable** and **relevant statutory provisions** are construed according to Section 2 of the Safety, Health and Welfare at Work Act 2005.

4.2 GENERAL OBLIGATIONS

4.2.1 Programme

1. In accordance with the Conditions of Contract and as stated in the Appendix to Tender, the Contractor shall within twenty one (21) days after the Notice to Commence submit his detailed programme to the Employer's Representative for review and approval.

2. The Construction Programme shall be in the form of computerized Network Precedence Diagrams incorporating activities for all work to be performed by the Contractor, his sub-Contractors and other Contractors to be employed in or about the site. It shall be supported by computer analysis and schedules and prepared in accordance with the principles of Critical Path Method (CPM) programming. The construction programme shall be prepared using the latest version of PRIMAVERA, OPEN PLAN or equivalent. One licensed copy of the software shall be furnished free of charge for the sole use of the Employer's Representative.

3. The Construction Programme shall be prepared by a qualified Network Analysis Engineer who shall be subject to the approval of the Employer's Representative and shall be skilled and experienced in construction programming of the kind specified for this project. The Network Analysis Engineer shall provide the Employer's Representative an access to his database for loading into the Employer's Representative's computer, whether by means of CD-ROMs or dataline communications.

4. The network diagrams shall be clearly and accurately presented with work activities relating to specific locations or levels grouped for ease of reference. Each work activity shall have the following information shown in the diagram.

    a) Activity number
    b) Concise description of the work
    c) Specification reference or trade code

d) Location of work or area code
e) Duration in calendar days.

5. Once the initial Construction Programme has been submitted and approved by the Employer's Representative, the Network Analysis Engineer shall perform monthly updates. The update will follow a visit to the job site where in the presence of the Employer's Representative, the Network Analysis Engineer will record the actual starts and percentages complete and, using this data, update the computer analysis. The updated analysis will be accompanied by a narrative report, which shall indicate the necessary action dates and requirements for material, labour and plant acquisition. The narrative report shall also focus upon the construction progress and shall particularly note conditions that may delay progress of the work. In the event of such delays, the Contractor shall describe actions proposed to overcome the adverse conditions to maintain the planned Construction Programme.

6. The Contractor shall carry out the Design Build Works in accordance with the latest approved Construction Programme. If any work is found not to be programmed during any regular review of the work, the Contractor shall immediately advise the Employer's Representative in writing of action proposed to ensure compliance with the programme. The Contractor shall thereupon prepare and submit a revised Construction Programme indicating such action, together with a list of revisions to programme logic. Correction and updating of the programme shall be carried out as often as necessary until the project is on programme.

7. Within five (5) working days after receipt of a notice from the Employer's Representative, the Contractor shall submit a revised Construction Programme for any of the following reasons:

   (a) When delays in completion of any activity or group of activities indicates a slippage of the Contract completion date or Milestone date by 14 calendar days or 10% of the remaining duration of the Contract period, whichever is less.

   (b) When delays in submittals or deliveries or work stoppage area encountered which make re-planning of the work necessary.

   (c) When the programme does not represent the actual execution and progress of the Work being performed in the field.

   (d) Where a change in the work sequence is proposed or has been instituted by the Contractor. Any such change should not, in any case, be made without the Employer's Representative's approval.

   (e) Where the issue of a change order or other instruction would significantly effect programme and/or progress of the works

8. Submittal of the Construction Programme for approval shall be in accordance with the following procedure:

   - The contractor shall submit his initial Construction Programme, in five copies and one digital, twenty one (21) days after the Notice to Commence. Such initial Construction Programme shall include the following completed documents:
     - Network precedence Diagram showing the sequence and interdependence of all items of work required under the Contract and Milestone dates.
     - All the computer analysis reports required under this Contract.
   - After approval of the Contractor's initial Construction Programme, all subsequent revision and monthly update submittals shall comprise the following:
     - five (5) prints of the Network Diagrams from the last approved Construction Programme, suitably marked up in red ink to show all revisions, and signed by the Contractor and all Sub-Contractors

- five (5) copies of the update Activity Status Report
- five (5) copies of all supporting data
- five (5) copies of the updated master working report

- Revisions and monthly updates to the Construction Programme shall be submitted within five (5) working days of the data date for inputting revised/updated information to create the revision/updated computer analysis. The data date for the first monthly update shall be one month after approval by the Employer's Representative of the Contractor's initial Construction Programme, and successive data dates shall be at monthly intervals. The said data date should coincide with the date of the site progress meeting at which time the records of progress are verified.

9. All costs in establishing, maintaining, revising and updating the Construction Program shall be borne by the Contractor.

10. Progress of work executed on site shall be indicated weekly on Contractor's copy of the Master Programme of Works and the short-term programmes and this information will be available for transfer by the Employer's Representative to other copies of the programme.

11. The programme submitted for approval shall show in detail all operations of significance to design, construction and commissioning in order to complete the Works by the due date. Besides the requirements of Sub-Clause 4.14 of the Conditions of Contract, the periods and dates for the submission of design calculations and drawings needed for construction and for the placing of orders for mechanical, electrical and instrumentation equipment and Plant as well as the periods and dates for review and approvals by the Employer's Representative shall be shown clearly in the programme, accompanied by the following additional details:

(a) a statement giving the numbers and categories of supervisory and professional technical staff,

(b) a statement giving the numbers and categories of all labour and tradesman,

(c) a list and type of major Contractor's equipment (including vehicles) which the Contractor proposes to employ on the Site,

(d) details of Contractor's methods of working for all operations on Site including allowances for all notices and approvals within the times included in the Contract,

(e) elapsed periods from the Commencement Date to:
- commencement and completion of submissions for approval of shop drawings,
- commencement of construction of Permanent Works on Site,
- latest required delivery date for puddle pipes and any other parts required for building into structures as construction progresses

12. The Contractor shall revise the programme whenever deviations from the previous programme become obvious or when requested by the Employer's Representative.

13. The acceptance of the Contractor's Tender and the relevant award of Contract shall not be deemed to confer the Employer's approval of any programme contained therein.

14. The date for the completion of all work related to the Project and the programme submitted with the Tender may require amending to comply with the overall programme for the whole of the Project. Such amendments will be subject to mutual agreement between the Employer's Representative and the Contractor and will form an integral part of the Contract.

4.2.2 Progress Reports

1. The contractor shall submit to the Employer's Representative, at intervals to coincide with Employer's Representative's site meetings, a Progress Report comprising as a minimum the following:

- Works in progress
- Off site activities
- Summary of progress against programme
- Sub-Contractors
  - On-site
  - Off-site
- Orders placed / procurement
- Labour resources
- Weather conditions
- Information received
- Information required
- Current / Anticipated Problems
- Adjoining Owner's / Neighbour Liaison

2. The report shall include a progress chart in a format to be approved by the Employer's Representative with each activity from the Master programme reviewed. The report shall include a copy of the master and short - term program marked up to show current situation.

3. The report shall include details of labour resources utilized compared to those planned at the commencement of the Works. If any circumstances arise which may affect the progress of the Works or alter the sequence the contractor must put forward proposals or take other action as appropriate to minimize any delay and to recover any lost time.

4. The Contractor shall provide prior to the commencement of the works a labour and plant resource in histogram format identifying the resources planned to be used during the currency of the Contract Works. The Contractor shall provide and maintain daily records of labour showing all persons on site. A log shall be maintained at the site entrance for personnel to sign in and off the project.

5. The Contractor shall provide the Employer's Representative within five working days of request with the programme implications of any proposed variation.

4.2.3 Technical Standards and Regulations

1. The works shall be designed, manufactured, constructed, tested and operated in accordance with all relevant Irish Statutory Regulations, Codes of Practice and harmonised European Standards. Where harmonised European Standards do not exist, Irish Standard Specifications and Codes of Practice or their equivalent in other EU member states should be used.

2. Where plant or materials to an Irish Standard specification, a British Standard specification or any other Standard specification of a member state of the European Community are called for, this requirement shall be read as including items to a relevant national Standard of any member state of the European Union, which provides and equivalent guarantee of standard and reliability.

3. Where items certified by the National Standards Authority of Ireland as complying with an Irish Standard are called for, the provisions of Circular Letter BM2/87, as amended by Circular Letter BC 14/92, shall apply, i.e. the requirement shall be read as either certified by the National Standards Authority of Ireland as complying with the Irish Standard, or shall be certified as complying with a relevant National Standard of another member state of the European Community, which provides and equivalent guarantee of safety and suitability. Certification to be by the National Standards Authority of Ireland.

4. Nothing in the Employer's requirements shall be construed as discriminating against products and materials manufactured in any of the member states of the European Community.

5. Compliance with these Standards and regulations shall be a minimum requirement. Plant or materials offered to other Standards shall be equal or superior in quality to those

specified and full details shall be supplied to the Employer's representative to demonstrate this. The Employer reserves the right to reject or approve any plant or materials manufactured to a different Standard which he considers to be unacceptable.

6. The decision to accept proposed Standards or regulations shall rest with the Employer's Representative on the basis of the following criteria:

   (a) the proposed Standards or regulations result in a design of the Works equivalent or better than the one specified, and

   (b) the proposed materials and/or equipment are equivalent or better than the ones specified, and

   (c) the proposed Standards or regulations shall meet all specified test requirements

4.2.4 Office for the Employer's Representative

1. The Contractor shall supply, construct and erect, furnish, maintain, service and insure for the entire construction period until the end of the Defects Liability Period at least 365 days after the issue of the Taking Over Certificate, or such later time as the Employer's Representative may direct, and to his satisfaction, and subsequently remove from the Site, a furnished office for the sole use of the Employer's Representative's staff concerned with the supervision of this Contract.

2. The precise location, layout and construction of the office unit shall be subject to approval, but shall comply with the following requirements:

   - The office (until the end of the Defects Liability Period – at least one year after the issue of the Taking Over Certificate) shall be of a temporary type substantially constructed either of prefabricated panels or mobile units designed for the purpose.
   - The walls shall be closed boarded and covered with an approved hardwearing surface for easy cleaning.
   - The windows shall be glazed with a suitable number of light openings protected by fly screens and removable outer shutters. Sunblinds shall be provided for all windows.
   - The office shall be internally wired for lighting and power. Electric lighting shall be provided by fluorescent tube fittings with diffusers, and a sufficient number of power sockets shall be provided for all electrical equipment.
   - The office shall be provided with a continuous supply of clean water. Adequate drainage and wastewater disposal shall be included.
   - The office shall comprise:
     - 3 office rooms of 25 m^2 each,
     - 1 meeting room of 30 m^2,
     - full toilet and washing facilities (male and female) with partition walls and a separate door for the exclusive use of the Employer's Representative and his staff,
     - kitchenette with water supply
   - The three office rooms shall contain each:
     - 3 writing desks with swivel desk chairs
     - 3 chairs
     - 3 filing cabinets
     - 3 cupboards
     - any other items necessary for the performance of supervision duties
   - The meeting room shall contain:
     - 1 large meeting table
     - 12 chairs
     - 2 filing cabinets
     - 2 cupboards
     - magnetic or hardboard notice boards
     - any other items necessary for the performance of supervision duties
   - The secretarial room shall contain:

- 1 writing desk with swivel desk chair
- 1 drafting table with stool
- 1 computer table for computer and printer
- 1 table for photocopy machine
- 2 chairs
- 2 filing cabinets
- 2 cupboards
- any other items necessary for the performance of supervision duties

- The kitchenette shall contain:
  - sink with hot/cold water tap
  - 1 boiler
  - 1 refrigerator
  - 1 small gas range
  - 1 cupboard
  - 1 refrigerated drinking water fountain
  - 1 set of glasses, cutlery, cups, plates etc. for 12 persons

3. The office shall be equipped with one IDD telephone line with 5 connected telephones, fax machine, photocopy machine (up to A3, with reducing/enlarging and sorting facilities), four latest Pentium technology computers connected to one A3 laser printers and one A0 size plotter. All equipment shall be quality brands and to the satisfaction of the Employer's Representative.

4. After the issue of the Taking Over Certificate (or such later time as directed by the Employer's Representative) until the issue of the Performance Certificate, the Contractor shall provide, maintain and service the necessary furnished office rooms in one of the buildings of the treatment plant to be agreed upon with the Employer's Representative.

5. During the whole period of operation of the offices, the Contractor shall bear all operating and maintenance costs including electricity, water, telephone and fax (excluding international calls), office consumables and regular cleaning.

4.2.5 Survey and Testing Equipment

1. The Contractor shall provide and maintain in proper calibration for the sole use of the Employer's Representative's staff:

   - 2 levels including levelling staffs
   - 1 theodolite
   - 2 maximum and minimum thermometers
   - 6 sets of string line ranging poles
   - 2 measuring tapes (50 m)
   - apparatus for testing aggregates, sands and fillers to a recognised Standard approved by the Employer's Representative

2. Any other equipment as the Employer's Representative may require for carrying out his duties and testing the Works shall also be provided by the Contractor.

4.2.6 Protective Clothing

1. The Contractor shall supply and maintain the following articles of protective clothing for the sole use of the Employer's Representative during supervision:

   - Protective safety helmets
   - Rain capes
   - Rubber boots
   - Safety shoes.

2. These items shall be supplied in the sizes required by the Employer's Representative and shall be replaced during the Contract as necessary allowing for fair wear and tear.

4.2.7 Assistance to the Employer's Representative

The Contractor shall provide such labour as is necessary to attend to office requirements, including watchman and cleaning services, and shall assist the Employer's Representative in surveying, measuring, supervising, checking, testing, examining or setting out the Contractor's work in any way whatsoever, at any time of the day or night during the duration of the Contract.

4.2.8 Signboard

Within four (4) weeks after the Commencement Date, the Contractor shall erect one notice board at the entrance to the Site. The text and layout of the signboard will be agreed with by the Employer's Representative and shall contain as a minimum the Employer's Name, the Project Name, the Consultant's Name, the Employer's Representative's Name, the Contractor's Name and the Contract Duration.

4.2.9 Record Photographs

1. The Contractor shall take photographs of entrance roads and adjacent structures prior to commencing construction to form a record of existing conditions.
2. The Contractor shall take photographs of the line of the outfall pipeline prior to commencing construction to form a record of existing conditions.
3. During construction, the Contractor shall take photographs of structures, buildings and major Plant on a monthly basis to form a record of the progress of works.
4. A professional photographer shall take the photographs, the extent and number of which shall be agreed with the Employer's Representative. A minimum of 36 pictures per month shall be taken. A CD containing all photographs shall be provided monthly. Design Works

4.2.10 General

1. All design work shall be carried out by skilled designers and shall be in accordance with the Conditions of Contract and appropriate Standards to provide a works in accordance with the Employer's Requirements
2. The design life of the individual elements shall not be less than presented below:

Element	Design Life
Buildings	60 Years
Underground Services (including all underground pipes)	60 Years
Tanks	60 Years
Steel Tanks	25 Years
Overground Pipe Supports	40 Years
Other Structures	60 Years
Piping (overground)	40 Years
Roads	40 Years
Process and Control Equipment	12 Years
Instrumentation and SCADA	12 Years
Mechanical and Electrical Components	25 Years

Table 9: Design Life

3. The Contractor shall prepare and submit to the Employer's Representative for his review, within the times stated below or given in a programme approved in accordance with the Contract, Preliminary and Final Construction Documents, As-Built Drawings, Operation, Maintenance and Safety Manuals and Training Manuals as may be called for therein or as the Employer's Representative may require. Any review carried out by the Employer's representative, irrespective of comment, requests for clarification or approval given or implied, shall in no way relieve the Contractor of his responsibility for ensuring the adequacy and completeness of the design.

4. The Employer's Representative shall have the right at all reasonable times to inspect all Contractor's Construction and other Documents of any part of the Works, at the premises of the Contractor, his Sub-Contractors and suppliers.

5. Any cost resulting from a delay in delivery by the Contractor of any of the Construction Documents and other information required under the Contract shall be borne by the Contractor.

6. All Construction Documents shall be submitted according to an approved programme of submissions in three (3) copies to the Employer's Representative for approval.

7. Once review has been completed, a further five (5) prints of each submission shall be submitted, which shall be deemed to be the final drawings to which the Plant and the Works shall be manufactured and/or installed and constructed.

8. All drawings, whether produced manually or by CAD, shall be in the form of dark lines on white background and shall bear the following information within a standard title block to be approved by the Employer's Representative: Project Name, Contract No., Package No., Drawing Title, Scale, Date of preparation, Type and Date of revisions, Drawing and Revision No. If so requested by the Employer's Representative, some of the drawings shall be prepared in colour or shall be coloured.

9. All layout and arrangement drawings shall be to scale and shall include a graphical scale to aid the use of photographic reproductions. All dimensions shall be given in SI metric units. Drawings shall normally not exceed A1 size.

10. The Contractor shall submit drawings and supportive data to the Employer's Representative for his approval at the stages described as follows:

    - Preliminary Construction Documents in time to allow the detailed design to proceed in accordance with the approved programme,
    - Final Construction Documents (as far as relevant to design, manufacture and construction) before start of manufacture or construction,
    - As-Built Drawings and documents one (1) month before the Tests on Completion,
    - Operation, Maintenance and Safety Manuals three (3) months before Performance Testing,
    - Training Programme two (2) months before the actual start of the Training Period.

11. Unless stated differently in the Contract Documents, all technical documents to be submitted by the Contractor shall be in the English language.

4.2.11 Preliminary Construction Documents

1. Within a period of twelve (12) weeks after the Commencement Date, the Preliminary Construction Documents (as far as relevant to design, manufacture and construction) shall be submitted to the Employer's Representative for review. The submission should be phased to facilitate orderly preparation by the Contractor and review by the Employer's Representative.

2. These Preliminary Construction Documents shall comprise, but not be limited to the following subject to the approval of the Employer's Representative:

    - preliminary process design and calculations,
    - layout of the wastewater treatment plant,
    - process flow diagrams,
    - preliminary hydraulic profile,
    - general arrangement drawings for the civil, mechanical and electrical systems,
    - preliminary outline foundation and building drawings,
    - road layout drawings,
    - function diagrams,
    - definition and classification of hazardous areas,
    - general layout drawings of mechanical and electrical equipment and Plant,

- general pipework layout diagrams,
- plant performance data,
- preliminary environmental review, assessment and comments
- updated safety file

3. In particular, the Preliminary Construction Documents of the electrical works shall include, but not be limited to the following:

- initial load calculations,
- overall single line diagram,
- single line diagrams of all switchgear and distribution boards,
- system fault, regulation and stability studies and calculations,
- layout and arrangement drawings of electrical equipment,
- preliminary electrical wiring and schematic diagrams,
- cable routing layout

4. In particular, the Preliminary Construction Documents of the instrumentation, control and SCADA works shall include, but not be limited to the following:

- preliminary process flow diagrams including all instruments, controls, switches and actuators as well as control lines,
- process control philosophy,
- process control, instrumentation and interconnection diagrams,
- general layout and arrangement of control cubicles,
- preliminary front layout of control cubicles,
- preliminary circuit and schematic diagrams,
- preliminary instrument cable routing layout,
- preliminary instrument schedule

4.2.12 Final Construction Documents

1. At the latest eight (8) weeks before the start of individual construction works or the placing of orders for mechanical, electrical and instrumentation equipment and Plant, the Final Construction Documents for the relevant works, equipment and Plant shall be submitted to the Employer's Representative for review.

2. These Final Construction Documents shall comprise, but not be limited to the following as reviewed by the Employer's Representative:

- final process design and calculations,
- plant performance data,
- final environmental assessment,
- layout of the wastewater treatment plant,
- process flow diagrams,
- final hydraulic calculations and profiles,
- pipeline design calculations,
- pipeline layout and connection details,
- longitudinal pipeline sections,
- routing and co-ordination diagrams for all services,
- building and civil works drawings,
- civil and structural design calculations,
- formwork and reinforcement drawings,
- final road layout, landscaping and site works,
- design of all mechanical, electrical, instrumentation and SCADA systems,
- mechanical arrangement and shop drawings,
- a report outlining the application of safety considerations to the design of the wastewater treatment plant

3. In particular, the Final Construction Documents of the electrical works shall comprise, but not be limited to the following:

- detailed load calculations and electrical design calculations on internal and external voltage depression, short-circuit, power factor correction, harmonics, power supply sizing, protection, etc.,
- detailed layout, specification and arrangement drawings of electrical equipment,
- cable schedules for all power, control, instrumentation and communication cables giving details as cable number, cable identification code, design current, size, length, voltage drop, short circuit rating, installation details, current rating criteria, ambient temperature, method of installation, etc., details of electrical protection,
- motor starting studies (all studies to be computer based),
- power cable schedules and calculations,
- load and drive schedules,
- communication and data transmission system details and layouts,
- earthing system details, layouts and line diagram,
- lightning protection system details and layouts,
- logic diagrams and control schematics showing the schematic logic of interlock, shut-down and special control circuits,
- panel layout drawings showing the positions of instruments mounted on panels and overall panel dimensions,
- multicore cable/tubing routing with an overall plot plan showing the approximate locations of the main junction boxes and the routing of the multicore cables including where applicable, cable trench cross-sections and cable tray layouts shall also be shown,
- list of materials
- Electrical instrumentation schematic diagrams shall show the connections between all apparatus included in the Works.
- All wiring diagrams shall include a schedule of apparatus, which shall explain any symbols, or abbreviations used and shall show clearly the details of multicore cables terminated in the equipment.

4. In particular, the Final Construction Documents of the instrumentation, control and SCADA-systems shall comprise, but not be limited to the following:

- final process flow diagrams including all instruments, controls, switches and actuator as well as control lines according to DIN 19227 or equivalent,
- detailed layout, specification and arrangement drawings of all instrumentation, control and SCADA equipment,
- symbolic instrument loop schematic,
- instrument schedule and instrument cable schedule,
- logic diagrams and control schematics showing the schematic logic of interlock, shut-down and special control circuits,
- instrument location drawings and area layout drawings showing the approximate location of the instruments, tapping points, panels, control valves, the routing of air headers, transmission tubing and wiring,
- panel layout drawings showing the positions of instruments mounted on panels and overall panel dimensions,
- multicore cable/tubing routing with an overall plot plan showing the approximate locations of the main junction boxes and the routing of the multicore cables. Where applicable, cable trench cross-sections and cable tray layouts shall also be shown,
- line diagrams of earthing arrangements,
- draft set-point and alarm list,
- list of materials

5. Moreover, any additional calculations, drawings and information required in order to illustrate the civil, mechanical, electrical or instrumentation requirements for the construction of the Works and the installation of the Plant shall be submitted for the approval of the Employer's Representative.

4.2.13 As-Built Drawings

1. The As-Built Drawings shall comprise, but not be limited to the as-built conditions of all civil, steel, mechanical, electrical, instrumentation, control and SCADA works as reviewed by the Employer's Representative and shall be submitted for review at least four (4) weeks before the start of the Tests on Completion.

2. If, after submission of the As-Built Drawings as mentioned above until the date of the issue of the Performance Certificate, changes in the Works are carried out by the Contractor, he shall amend the As-Built Drawings accordingly and submit them again to the Employer's Representative for review.

4.2.14 Operation, Maintenance and Safety Manuals

1. The Contractor shall provide three (3) sets of comprehensive Operation, Maintenance and Safety Manuals in English, each with two sets of drawings at least three (3) months before the anticipated date of the first of the two Performance Tests.

2. These Manuals shall describe in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works and shall include necessary safety instructions for Operation and Maintenance.

3. Specific items of the Works shall be described in detail so that no ambiguity arises.

4. A collection of standard pamphlets of general nature unaccompanied by detailed drawings and descriptions relating to the installed equipment and Plant will not be accepted.

5. Any operation likely to be carried out during the life of the wastewater treatment plant shall be described in the form of a step by step procedure and shall include annotated drawings, tolerances, charts or diagrams to indicate the requirements for:

   - safety precautions
   - dismantling
   - reassembling
   - operation
   - monitoring and control
   - adjustment
   - identification of faults
   - testing
   - inspection
   - lubrication
   - preventive maintenance
   - routine maintenance
   - replacement of worn parts and overhauls
   - ordering of spare parts

6. The types and grades of all lubricants required for maintenance shall be listed in a lubrication chart, which shall include a schedule for routine maintenance to ensure trouble-free operation.

7. All items that will be subjected to wear during service shall be illustrated. Guidelines shall be provided on the maximum permissible wear before any such item needs replacing.

8. Methods for the measurement of wear with lists of tolerances and other dimensional limits shall be included. A list of items and minimum quantities that are recommended as spare parts shall be provided.

9. To facilitate the preparation of the manuals and their utilisation, they should each be divided into three volumes:

- **Volume 1 - Plant Operation and Routine Maintenance Requirements**
  This should be short and concise and set out the operating procedures together with safety instructions and a consolidated schedule of requirements for inspection, lubrication and other duties to be carried out by unskilled and semi-skilled operators. Typical log sheets from which the Employer can complete daily, weekly or monthly record sheets of the treatment plant performance and service should be included.
- **Volume 2 - Plant Overhaul and Replacement**
  This will provide the detailed information required by skilled maintenance fitters and engineers for use in locating faults and carrying out repairs, replacements and major overhauls.
- **Volume 3 - Technical Documentation**
  This will contain a general description of the wastewater treatment plant and detailed particulars of all equipment, which will be required for reordering spare parts and analysis of the plant performance or deficiencies.

4.2.15 Procedure for Review of Construction Documents

The Employer's Representative shall have no authority to relieve the Contractor of any of his duties, obligations or responsibilities under the contract. Any proposal, inspection, examination, test, consent, approval or similar act by the Employer's Representative (including absence of disapproval) shall in no way relieve the Contractor from his responsibility.

1. As soon as possible and at the latest within twelve (12) weeks after the Commencement Date, the Contractor shall submit to the Employer's Representative three (3) copies of the Preliminary Construction Documents including certified general arrangement drawings in adequate detail to be examined, reviewed, accepted or rejected by the Employer's Representative as described in the following sub-clauses. Preliminary drawings shall include details and main dimensions of individual items and of the general arrangement of the whole of the Works. The submission should be phased to facilitate orderly preparation by the Contractor and review by the Employer's Representative.

2. A similar procedure shall apply for the Final Construction Documents, the Shop Drawings and Supplementary Construction Drawings, which shall be submitted in three (3) copies to the Employer's Representative at the latest eight (8) weeks before:

   - the start of individual construction works,
   - the placing of orders for mechanical, electrical and instrumentation equipment and Plant,
   - before the start of manufacturing specific items of equipment and Plant

3. The Contractor shall be solely responsible for the accuracy, completeness and correctness of all Construction Documents prepared by him or any of his Sub-Contractors. He shall not authorise a Sub-Contractor to deal directly with the Employer's Representative with regard to documents and drawings.

4. All Shop Drawings/Supplementary Construction Drawings and Documents for items of mechanical/electrical equipment constituting an operational system shall be submitted concurrently.

5. However, if the Contractor is considered by the Employer's Representative to have made a bulk submission of documents and drawings which makes it impossible for the Employer's Representative to review them properly within the period specified using the staff available to him, the Employer's Representative shall so advise the Contractor and the period will be extended to a reasonable period, to be agreed between the Employer's Representative and the Contractor's Representative, appropriate to the work load, and the Contractor shall have no claim for damages or extension of time due to any delay resulting from this extension.

6. Thirty (30) days shall be allowed for review by the Employer's Representative following receipt of the Construction Documents, and thereafter, subject to the following sub-

clauses, the Contractor shall provide five (5) additional copies of the reviewed and/or corrected submissions as indicated below.

7. If one copy of the submission is returned to the Contractor marked "REVIEWED - NO CORRECTIONS NECESSARY", revision of said submission will not be required and the Contractor shall immediately submit five (5) additional copies to the Employer's Representative for his records.

8. If one copy of the submission is returned to the Contractor marked "REVIEWED - MAKE CORRECTIONS NOTED", the Contractor shall revise the submission and submit five (5) additional copies to the Employer's Representative for his records, within 21 days.

9. If one copy of the submission is returned to the Contractor marked "AMEND AND RESUBMIT" or "REJECTED - RESUBMIT" with the Employer's Representative's comments noted thereon, the Contractor shall amend the submission and submit a further three (3) copies of said amended submission to the Employer's Representative for further review within 21 days. This procedure shall be repeated until the Contractor receives a copy of the submission from the Employer's Representative marked “REVIEWED - NO CORRECTIONS NECESSARY" or " REVIEWED - MAKE CORRECTIONS NOTED", after which the Contractor shall submit five (5) additional copies to the Employer's Representative.

10. If one copy of the submission is returned to the Contractor marked "NOT SUBJECT TO REVIEW", revision of the submission will not be required and the Contractor shall immediately submit five (5) additional copies to the Employer's Representative for his records.

11. Fabrication of an item shall not be commenced, nor any items shipped, before the Employer's Representative has received the submission and returned one copy to the Contractor either marked "REVIEWED - NO CORRECTIONS NECESSARY" or "REVIEWED - MAKE CORRECTIONS NOTED".

12. Necessary corrections and amendments indicated on submissions shall be considered as changes necessary to meet the requirements of the Contract and shall not be taken as the basis of any claim for extra work and/or cost.

13. The Contractor shall have no claim for damages or extension of time due to any delay resulting from making required revisions to submissions.

14. The review of the said submissions by the Employer's Representative shall in no way relieve the Contractor of his responsibility for errors or omissions contained therein, nor shall such review operate to waive or modify any provision or requirement contained in the Contract.

15. As soon as possible after the Employer's Representative's review of submissions and in any case at the latest four (4) weeks before the start of individual construction works, the Contractor shall submit to the Employer's Representative three (3) copies of the relevant certified foundation drawings for information. These drawings shall indicate the dimensions and location of all openings required in the floors and walls for pipes, cables, foundation bolts, supports, etc. In addition full information shall be provided of the foundation loadings, predicted noise levels (1 m from the operating Plant), vibration characteristic and other features which could affect the design of the buildings, foundations or other civil works.

16. Prior to the issue of the Performance Certificate, the Contractor shall provide two further prints and a reproducible transparent film of all drawings correctly modified as final record submissions complete with related schedules of quantities and particulars. Amendments to the Works found to be necessary during the Tests after Completion and the Operation and Maintenance Period shall be included in these submissions.

17. All drawings shall be properly lettered and numbered to identify each part of the Plant for maintenance, repair and for ordering of replacement parts. Each drawing shall include in the title block the information precisely specified.

18. Drawings for the whole Contract, as described above, shall be drawn on ISO Standard A1 size sheets with the standard title blocks clearly describing the drawing content. Drawings larger than A1 size will only be accepted upon the written approval of the Employer's Representative.

19. The costs of all design work, documents and approval procedure shall be included in the Contract Price.

4.3 CONSTRUCTION WORKS

4.3.1 Construction Requirements

1. The Contractor shall construct the Works in accordance with the Contract within the time specified in the Appendix to the Form of Tender.

2. Construction works shall comprise the Temporary Works, the Permanent Works and the Plant and shall include all components and units necessary to fulfil the requirements of the Contract including, but not limited to the components of the Works as described in Clause 2.8 above.

4.3.2 Water and Electricity on Site

1. During construction, arrangements for the Contractor's water, electricity and telecommunication supply for the purpose of the Works shall be made by the Contractor at his own cost.

2. Water and wastewater originating from the construction, testing and completion of the Works shall be disposed of clear of the Site to the satisfaction of the Employer's Representative and all concerned authorities, so as to cause no damage or complaint.

4.3.3 Existing Services

1. Before any work commences, the Contractor shall identify and record all utilities and services, both above and below ground, including pipes, channels, watercourses, navigation, ducts, cables, lines, poles, buildings, roads, footpaths, posts and other services that have to be diverted or relocated, either temporarily or permanently for the construction of the Works. He shall make all necessary arrangements for their diversions and reallocations including any investigations, design, construction, re-commissioning, security of permits and agreements.

2. All costs arising from or associated with such works, however incurred, shall be borne by the Contractor, whether foreseen or not.

3. The Contractor will be held responsible for damage to any existing services or utilities caused by his operations. Any damage caused shall be made good at his cost and to the satisfaction of the Employer's Representative.

4.3.4 Safety

1. It is the intention of the Employer to appoint the Contractor as Project Supervisor Design Process and as Project Supervisor Construction Stage in accordance with the requirements of the Safety, Health and Welfare (Construction) Regulations S.I. 504 of 2006

2. The provisions of the relevant legislation and all amendments thereto, shall be fully complied with at all times. In particular the following shall be complied with:

   - The Factories Act (1955)
   - The Safety, Health and Welfare at Work Act (2005)

- The Safety, Health and Welfare (General Applications) Regulations S.I. 44 of 1993
- The Safety, Health and Welfare (Construction) Regulations S.I. 504 of 2006

3. A complete list of Irish Health and Safety legislation is available from the Health and Safety Authority, Publication Department, 10 Hogan Place, Dublin 2 and all of the relevant legislation shall apply to the works.

4. The Contractor shall comply with the relevant provisions of "Safe Working in Sewers and Sewage Works" published by the National Joint Health and Safety Committee for the water service in the UK.

5. Unless otherwise stated the following shall apply with regard to safety:

   a) The Contractor shall be responsible for observing local safety regulations and for taking all necessary measures to safeguard all personnel working on the Site from any risks which may arise out the Works.

   b) In particular, he shall ensure that only persons who are properly trained for their duties are employed and that the correct tools and procedures are used.

   c) Work on electrical plant shall be undertaken only under such conditions as are consistent with electrical safety, and all dirt, dampness, water, oil and other substances which may adversely affect electrical safety shall be rigorously excluded.

   d) All electrical plant shall be searched for the presence of tools or other foreign objects before being energised, in addition to the usual insulation tests.

   e) The installation shall be laid out so that no item of plant is so positioned that danger to personnel could arise during routine operation and servicing. This applies particularly to any hot pipes, electrical connections and pressure relief valves. Approved guards must be fitted to all moving machinery.

   f) Nothing which has been written into or omitted from these Employer's Requirements shall be taken to relieve the Contractor from his obligations under this Clause, neither shall it be taken to prevent the Contractor from drawing the attention of the Employer's Representative to any feature of the Works which is not consistent with normal safety practices, nor to prevent him putting forward proposals at any time which would increase the safety of the installations.

4.3.5 HAZOP

1. The Contractor shall carry out a Hazard and Operability Study (HAZOP) for the works at an appropriate stage in the design. Modifications to the Contractor's design or construction that are required as a result of the HAZOP shall be implemented by the Contractor at his expense.

2. The HAZOP shall be carried out in accordance with the recommendations of chapter 2 of "HAZOP and HAZAN Notes on the Identification and Assessment of Hazards" by Trevor A. Keltz published by the UK Institution of Chemical Engineers.

3. The following shall be included in the studies:

   - The design, including all process and instrumentation diagrams, all single line diagrams, plant layout drawings, pipeline drawings and block diagrams for the control system.
   - An ICA design appraisal.

4. A two stage approach shall be used. The first stage will be carried out at the stage when Process and Instrumentation diagram are available and the results shall then be used to further develop the design. The second stage will review both the P&I final diagrams and the ICA systems to ensure that the overall system design provides adequate operational security.

4.3.6 Noise

1. The Contractor shall ensure that the noise levels in any area outside the Site, arising from the operation of the Plant, shall not exceed 50 dB (A) 30 min Leq between 8 am and 8 pm and 40 dB (A) 30 min Leq between 8 pm and 8 am.
2. The Contractor shall ensure that in any area of the Works requiring attendance the personnel shall be safely protected against noises exceeding 85 dB (A).
3. The Contractor shall indicate what measures he proposes to attenuate the noise generated by motors, compressors and other equipment and shall provide an estimate of the likely noise levels in the various areas of the treatment plant.
4. For reference, information on the noise levels generated by similar Plant operating in similar installations shall be included with an indication of the measures of attenuation taken there.

4.3.7 Samples

1. The Contractor shall submit the following samples, as appropriate, to the Employer's Representative for pre-construction/pre-installation review:
   - paints, coatings, tiles, flooring, suspended ceilings,
   - electrical fittings, switches, wall outlets, indoor/outdoor lighting fixtures,
   - sanitary fittings, taps,
   - door and window fittings,
   - louvres, shades,
   - chequer plates, open mesh plates (catwalks), handrails
2. All samples shall be clearly marked and/or labelled, identifying manufacturer, product type, catalogue number and/or ordering code and the intended location/use in the Works. They shall be submitted by the Contractor with manufacturer's certification of guaranteed compliance with the Employer's Requirements and/or specific relevant industrial standards. Approved samples will be kept under lock by the Employer's Representative at Site and shall be used as references for quality control.

4.3.8 Notice of Operations

1. The Contractor shall give written notice of all important operations to the Employer's Representative, sufficiently in advance, to enable the Employer's Representative to make such arrangements as he may consider necessary for inspection or for any other purpose.
2. The Contractor shall not commence any important operation without the written approval of the Employer's Representative.

4.3.9 Installation on Site

1. The Contractor shall provide the services of a team of competent erection engineers and skilled mechanics to ensure:
   - the reception, checking, storage and unpacking of the equipment and materials at Site,
   - the erection of the Plant,
   - the checking of the installation for accuracy and the testing and commissioning of the Plant
2. This team will also be required to provide instruction to any labour that the Employer may wish to provide in order that his staff may become familiar with the equipment.
3. The Contractor shall supervise others to ensure that the position, levels and dimensions of the Plant are correct according to the drawings, notwithstanding that others may have

been assisted by the Employer's Representative in setting out the said positions, levels and dimensions.

4. All managerial and supervisory staff allocated by the Contractor to work at the Site shall be fully conversant with the type of installation, the programme of work, and the commissioning and maintenance requirements for the proper completion of the Works.

5. The Contractor shall allow for the completion of the installation in co-ordination with other Contractors on the Site and for the setting to work either in stages, or without interruption, at the discretion of the Employer's Representative. He shall allow for leaving the Site and returning to set to work outstanding items and to commission and test the Plant to the Employer's Representative's approval at times appropriate to the programme for the complete Site as determined by the Employer's Representative.

6. The Contractor shall not withdraw any of his staff from the Site during the course of installation and commissioning without first obtaining the approval of the Employer's Representative.

4.3.10 Provision of Tools and Appliances

1. The Contractor shall provide two complete sets of tools, lifting tackles and greasing equipment for each component of the Plant.

2. Certain basic requirements for tools and appliances may be specified in the Employer's Requirements. The Contractor shall interpret (and if necessary supplement) these requirements in relation to the design of the Plant being supplied when making up the schedule of tools and appliances.

3. The tools and equipment shall be supplied at the same time as the major items of Plant and shall be handed over to the Employer prior to the issue of the Taking Over Certificate in a serviceable condition, excepting that the Employer's Representative may call upon the Contractor to demonstrate their use.

4. Standard tools shall be boxed in strong steel or steel bound wooden boxes marked or labelled with their contents and fitted with hasps and locks.

5. All special tools and test equipment necessary for overhauling the Plant and testing its performance shall be included and mounted in suitably designed cabinets with lockable doors. Racks and clips shall be provided for individual items and labels to show where any equipment is missing.

4.3.11 Provision of Vehicles

1. The Contractor shall supply all vehicles necessary for the efficient operation and maintenance of the Works after completion.

2. Such vehicles shall include sufficient vehicles/skips to transport the residuals to their ultimate disposal site, a mobile crane for lifting heavy equipment, other vehicles necessary for operation and maintenance, and one pickup for normal operations.

4.3.12 Provision of Spare Parts

1. The Contractor shall supply with the equipment and Plant, the spare parts, which the various manufacturers consider necessary to be held in stock to meet the requirements for 2 (two) years' operation and maintenance. The manufacturers' written confirmation of recommended spare parts shall be submitted to the Employer's Representative for review, together with a relevant schedule of spare parts, listing all spare parts item by item, quoting the appropriate numbers, prices and part numbers, which can be identified with reference to the drawings of the equipment and Plant.

2. The spares should comprise an adequate stock of the parts likely to be needed as routine replacements, together with any major items or components which may be desirable to

hold in order to facilitate or expedite putting the treatment plant back into service after a failure.

3. Certain basic requirements for spares in both categories may be specified in the Employer's Requirements. The Contractor shall interpret (and if necessary supplement) these requirements in relation to the design of the Plant being supplied when making up the schedule of spare parts.

4. Spare Parts shall be new and shall be packed separately from the main equipment and Plant in packages or containers designed to preserve the spares from the effects of long term storage under the ambient conditions. Any items, which cannot be packed in this way, must be protected from corrosion by applying temporary protective coatings and shielded from mechanical damage.

5. All items of spare parts shall be clearly labelled with brief descriptions and part numbers. The packed items shall be easily identified without the necessity of unpacking them. All packages shall bear the name and brand of the manufacturer.

5.0 INSPECTIONS AND TESTING

5.1 INSPECTIONS AND TESTING AT MANUFACTURERS' SITE

1. All major parts of equipment and Plant shall be inspected and/or tested by the Contractor or by an internationally recognised inspection office at the manufacturers' place, prior to shipment. As far as directed by the Employer's Representative, he will witness such inspections and/or tests.
2. The Contractor shall give notice to the Employer's Representative at least eight weeks before any equipment or Plant is ready for inspection and/or testing, and the Employer's Representative will notify the Contractor in advance if he intends to witness the said inspection and/or test.
3. In order to facilitate the attendance of the Employer's Representative at such inspection and/or testing, the Contractor shall hand over to the Employer's Representative two (2) complete sets of the approved documentation covering the equipment and Plant to be inspected and/or tested. This shall include, but not be limited to general information, performance criteria, power requirements, material specification and certificates, installation instructions, noise levels and so forth.
4. The Employer's Representative's cost in connection with the inspections and/or tests will be borne by the Employer, if the equipment and Plant inspected and/or tested fulfils the requirements of the Contract. In case the requirements are not fulfilled and an inspection and/or test has to be repeated, the cost of the Employer's Representative for a further inspection and/or test visit shall be borne by the Contractor.
5. No material or item of plant and equipment shall be delivered to site without prior inspection, testing and certification, where applicable, unless the Employer's Representative confirms, in writing, that such inspection, testing and/or certification is not required.

5.2 TESTS ON COMPLETION AND TAKING OVER

5.2.1 General

1. The requirements for acceptance in this Contract are to satisfy the Employer that the Works are complete, have been constructed, tested, demonstrated to work and that the performance of the Works meets the Employer's Requirements and the guarantees provided by the Contractor.
2. Acceptance by the Employer will require completion of initial training and submission of Construction Documentation including operating and maintenance manuals, calculations, financial model and drawings, one set of which will be retained by the Employer for his record purposes.
3. The Contractor shall demonstrate to the satisfaction of the Employer's Representative that:
   - ✓ the Works is capable of producing the required standard of final effluent, storm effluent and that the sludge product, screenings, grit, and waste products meet the requirements of the Employer's Requirements;
   - ✓ the Works complies fully with the Employer's Requirements and with the Tender, including any changes agreed with Employer; and
   - ✓ all Plant and Materials are suitable for their intended purposes.
4. The Tests on Completion shall not commence until the whole of the Works is complete and ready for Testing. During the period(s) of phased introduction of process unit(s) and Plant, the Contractor shall be responsible for all costs associated with the introduction.
5. The schedule for the introduction of process unit(s), commissioning, testing and Tests on Completion shall be included on the Programme of Works.

6. The Works shall comply with the Environmental Standards specified in terms of odour, noise and visual appearance.

7. All items of Plant and Materials shall be tested to demonstrate that they operate in accordance with the information provided in the Functional Design Specification (FDS) when operated in both manual and automatic control.

8. All items of Plant provided under the Contract shall be subject to inspection and test which shall be witnessed by the Employer's Representative during software preparation, manufacture, installation and commissioning. The consideration of the Employer's Representative of the results of any such inspection or test shall not prejudice the right of the Employer's Representative to reject the Plant if it fails to comply with the Employer's Requirements when installed or to give complete satisfaction in service. The costs of all such tests, including the provision of the necessary test equipment whether at the manufacturer's premises or on Site, shall be borne by the Contractor.

9. The Contractor shall submit to the Employer's Representative fully detailed documentation of his inspection and test procedures to ensure that all designs and requirements of the Contract and in particular, the Functional Design Specification have been met. Test documentation shall be required for all phases of testing and must be considered by the Employer's Representative prior to the commencement of testing.

10. Testing and inspection of the Works shall be witnessed by persons nominated by the Employer's Representative.

11. No inspection, acceptance, agreement or issue of a Statement of No Objection by the Employer's Representative or his staff, of the Works, Plant and Materials covered by this Contract shall release the Contractor from any of his obligations under the Contract.

5.2.2 Pre-commissioning and Commissioning Tests

1. The pre-commissioning and commissioning tests under dry and wet conditions as appropriate, shall include all procedures and functions, safety, emergency as well as normal procedures.

2. The Contractor shall set out, in his Construction Documentation, a full list of the pre-commissioning and commissioning tests to be carried out under the Contract to prove compliance with the Employer's Requirements and the General Technical Specifications Volumes 8, 9 & 10. Such tests shall include, but not necessarily be limited to: -

<u>Test of structures and pipes</u>

- ✓ Leakage and pressure tests
- ✓ Construction materials testing.

<u>Tests of mechanical equipment</u>

- ✓ Tests of correct direction of rotation of motors,
- ✓ Tests of automatic operation,
- ✓ Tests of manual operation,
- ✓ Tests of capacity of all machines individually and as part of the entire plant,
- ✓ Tests of quality of materials.

<u>Tests of electrical equipment</u>

- ✓ Tests of alarm systems,
- ✓ Tests of the emergency switch system,
- ✓ Tests of manual operation,
- ✓ Tests of all interlocking systems,
- ✓ Tests of indications,
- ✓ Tests of all panel functions,
- ✓ Tests of safety systems,
- ✓ Tests of all signals to the SCADA PLC,
- ✓ Tests of modifications of the control systems (new start and stop level etc),
- ✓ Full test of all signals to and from the PLCs, instruments and signal converters.

3. All testing under “dry” conditions shall be completed to the satisfaction of the Employer’s Representative prior to the introduction of “wet” conditions to the plant.

4. All necessary consumables, spare parts, tools, lubricants, etc. for the carrying out of tests shall be supplied by the Contractor as part of the Contract.

5.2.3 SCADA / PLC Site Tests

1. Site tests shall only be undertaken when the inspection and testing at the manufacturer’s works have been completed to the Employer’s Representative satisfaction and that any faults found have been corrected.

2. These tests shall include the SCADA master stations, PLCs, control panels, Plant and data communications highways being tested as a complete integrated system in the presence of the Employer’s Representative. These tests shall ensure that the complete works is displayed, monitored and controlled in accordance with Functional Design Specification requirements.

5.2.4 Aeration Testing

1. All aeration devices specified by the Contractor shall be subject to clean water tests the purpose of which will be to establish compliance with the:

   a) aeration capacity (kgO_2/h);
   b) air flow rates (m^3/h);
   c) blower maximum operating differential pressure (kPa); and
   d) aeration efficiency (kgO_2/kWh)

   claimed by the Contractor for the Plant installed. The Contractor shall demonstrate that the above parameters, as guaranteed by him, can be achieved in three successive tests under the same conditions, i.e. each test is carried out in triplicate.

2. Tests will be undertaken according to the latest available edition of the American Society of Civil Engineers (ASCE) Standard for Measurement of Oxygen Transfer into Clean Water.

5.2.5 Trial Operation – Process Proving

1. Once the pre-commissioning and commissioning tests have been completed to the satisfaction of the Employer’s Representative the Contractor shall operate and maintain the plant, in accordance with the draft operation and maintenance manuals, for a trial period of not less than two months. During this period the Employer’s Representative shall have the opportunity to witness all operation and maintenance activities, the objectives of which are to optimise the function and operation of the entire plant.

2. Before starting the trial operation the Contractor shall, at his own cost, ensure that all tanks are filled with consumables and provide the necessary seeding sludge to start-up the process.

3. Trial operation in the period shall be conducted under both automatic and manual control as directed by the Employer’s Representative to prove the functionality and reliability of the control systems.

4. During the trial operation period, the biomass shall be built up to design level and until excess sludge production takes place. The process-proving period shall not commence until this occurs and shall last for a minimum of 30 days thereafter. During the process-proving period the plant shall be operated in fully automatic mode. Since the initial loading of the plant could be as little as 25% of the design loading the Contractor shall allow in his procedure for this and also for testing each stream in turn.

5. Trial operation in the period shall be conducted under both automatic and manual control as directed by the Employer’s Representative to prove the functionality and reliability of the control systems.

6. In order to demonstrate that the constructed treatment plant conforms with the Employer's Requirements and the Performance Guarantees offered by the Contractor at Tender stage the Contractor shall carry out performance tests in accordance with the following requirements: -

General

The performance of the whole of the works and each process unit shall be demonstrated to be in compliance with the Employer's Requirements, Performance Guarantees and the Contractor's design for the average and peak hydraulic flows and organic loads as set out in Section 3.3 of this Volume.

The Contractor shall be responsible for setting up a system for completing the necessary performance tests and reporting the results indicating whether or not compliance with the Employer's Requirements and Performance Guarantees has been achieved.

The following conditions shall apply during the process proving period: -

- ✓ Each process stream shall be operated continuously at the available daily average flow and load.
- ✓ Air flow rates shall be recorded during the proving period to show adequate capacity to treat full load.
- ✓ The results of tests shall be adjusted to take account of the difference between the design and actual flow and loads, where the Employer's Representative considers appropriate.
- ✓ All air treatment units shall be operated with the design air load.

Screens

There shall be minimal visual evidence of carry-over of un-screened material into the grit removal Plant, primary sedimentation tanks (where present) or secondary treatment units. This assessment shall be based on floating objects which are recognised by the Employer's Representative to be screenings.

The effectiveness of the screenings washing shall be judged by the Employer's Representative on the basis that there shall be no offensive odours arising due to degradation of faecal material from the screenings skip after storage for up to three days. This shall be determined on a reasonable basis, allowing for both individual opinion and distance from skip, with the purpose of confirming that faecal matter has been removed from the screenings.

In addition, the water content of the screenings shall be such that transport of the screenings from the Site can be carried out without loss of water from the screenings container and that the screenings are sufficiently dry and odour free for disposal at a local landfill or other suitable disposal outlet without any cause for complaint. The maximum moisture content shall not exceed 20%.

Grit removal

The quality of grit in terms of volatile matter and water content shall not exceed the Contractor's guarantee. This shall be tested by taking a sample of grit at a suitable point prior to discharge to the collection skip and analysing for volatile solids and water content. This shall be undertaken three times per week, at times agreed with the Employer's Representative.

Primary sedimentation tanks

Where primary treatment is included in the Design-Build Works, analysis of settled wastewater will be carried out for BOD, COD and TSS in order to establish whether the removal efficiency specified by the Contractor is being achieved.

The weekly volume of sludge produced will be recorded. A daily composite sample of primary sludge will be taken weekly and analysed for dry solids content. The sludge solids content shall not be less than 3% ds.

The effectiveness of scum removal facilities will be assessed on the basis of visual inspection by the Employer's Representative.

Biological treatment

It shall be demonstrated, to the satisfaction of the Employer's Representative, that the specified system of control is suitable for automatic operation of the plant and that the operational parameters specified by the Contractor can be maintained within the ranges given.

Where activated sludge treatment is proposed, automatic operation shall be monitored. Attention shall be given to MLSS concentration, the DO profile through the tanks, RAS flow rate and solids content. Performance shall be monitored at both average and peak design hydraulic flow and where possible corresponding biological loads as described in Section 3.3 of this volume. The performance of the final settlement tanks shall be monitored at both average and peak design flow. Attention shall be given to distribution of mixed liquor, withdrawal of RAS, scraper operation and scum collection and removal.

Where SBR treatment is proposed, automatic operation shall be monitored. Attention shall be given to the correct operation of sequences for individual process stages for cycling between reactors, the MLSS concentration at TWL and BWL, the DO profile during the cycle, the overflow rate of settled effluent, scum collection and removal and the wastage of surplus sludge. Performance shall be monitored at both average and peak design hydraulic flow and biological loads as described in Section 3.3 of this volume.

Where BAF treatment is proposed, automatic operation shall be monitored. Attention shall be given to sequences for backwashing for each cell and between cells, the volume and solids content of the backwash water, the recovery period after backwash and the loss of media from the cells. The performance shall be monitored at both average and peak design hydraulic flow and where possible corresponding biological loads as described in Section 3.3 of this volume.

Disinfection

Automatic operation shall be monitored for UV Plant, power consumption, lamp life, transmissivity and UV intensity and the maintenance required, to maintain efficient operation, shall be monitored.

Treated Effluent Quality

A minimum of 30 sets of consecutive flow proportional 24 hours inlet and outlet samples shall be taken and analysed for COD, BOD, Suspended Solids, N and P by an accredited laboratory.

Each and every outlet sample shall be in compliance with the final effluent quality standards set out in Table 7: Treated Wastewater Criteria of this Volume.

Sludge Thickening

Where sludge thickening Plant is included in the Works, the Plant shall be monitored for automatic operation. Attention shall be given to the volumetric throughput, chemical consumption, recycle and make-up water consumption, returned liquor quality and the dry solids content of the thickened sludges. It shall be demonstrated to the Employer's Representative that the specified control is suitable for automatic operation of the Plant and that the operational parameters specified by the Contractor can be maintained within the range given.

Sludge Dewatering

Sludge dewatering Plant shall be monitored for automatic operation. Attention shall be given to the volumetric throughput, chemical consumption, washwater consumption, returned liquor quality and the dry solids content of the dewatered sludges. It shall be demonstrated to the Employer's Representative that the specified control is suitable for automatic operation of the Plant and that the operational parameters specified by the Contractor can be maintained within the range given.

Sludge

The volume and Dry Solids content of the daily Waste Activated Sludge shall be recorded over the process proving period to show the excess sludge quantities generated by the plant.

An accredited laboratory shall carry out the analysis and determination of the dry solids concentration of sludge.

Odour

An accredited laboratory shall carry out all odour sampling and analysis.

Air samples shall be taken at the site boundary at four locations twice during the process proving period. Sampling shall be carried out in accordance with the German Standard Method VDI 3881 (1987) and analysis shall be by Dynamic Olfactometry in accordance with CEN Standard TC264 (1999) the results being expressed in odour units per cubic meter of gas (ou/m^3). The Employer's Representative shall determine the time and location of measurement.

Acceptance of the odour control system by the Engineer's Representative shall be based on the system demonstrating that it performs in accordance with the requirements set out in Clause 3.3.4 in this volume.

The level of mercaptans and hydrogen sulphide expressed in mg/m^3 shall also be measured that the four site boundary locations and at eight other locations within the works to be determined by the Employer's Representative.

In addition to the above the performance of each odour treatment unit shall also be determined by weekly measurement of mercaptans and hydrogen sulphide expressed in mg/m^3 at the exhaust of the odour treatment unit.

Noise

The noise level at the site boundary shall be measured at six locations twice during the process proving period. The Employer's Representative shall determine the time and location of measurement.

Acceptance of the completed works relating to acceptable noise levels at the site boundaries by the Engineer's Representative shall be based on the system demonstrating that it performs in accordance with the requirements set out in Clause 3.3.5 in this volume.

The noise level at 1 m distance from all noise producing equipment shall be measured once during the process-proving period at a time to be determined by the Employer's Representative.

Noise levels shall be measured by a Certified Body.

Power, Water and Chemical Consumption

During the process-proving period the Contractor shall measure the weekly power, water and chemical consumption of each process unit and from this establish the average yearly site consumption under design conditions.

5.2.6 Taking Over

1. Once the Contractor is satisfied that the trial operating period has been successfully completer and that the necessary performance tests, to demonstrate compliance with the Employer's Requirements and Performance Guarantees, have been satisfactorily completed he shall submit a final test report to the Employer's Representative summarising the test results. This report shall be accompanied by: -

   - ✓ A statement from the Contractor that, in his opinion, the Works have passed the Tests on Completion; and
   - ✓ An application for a Taking-Over Certificate.

2. The Employer's Representative shall, within 28 days of receiving the Contractor's application and subject to the provisions of Sub Clause 10.1 of the Volume 2: Conditions of Contract Part IIA, issue a Taking-Over Certificate or reject the application outlining the necessary works to be completed to enable a Taking-Over Certificate to be issued.

3. The issuing of the Taking-Over Certificate by the Employer will take place only after the Operation and Maintenance Manual, the As-Built Drawings and the Quality Assurance and Test Report have been fulfilled to the satisfaction of the Employer's Representative and passed over to the Employer.

4. The Contractor shall also have available at the Works a complete Health and Safety File as required by the Health and Safety Regulations. A copy of this document shall be submitted to the Employer's Representative for review at least one month before take-over by the Employer.

5. The issue of the Taking Over Certificate commences the Operation and Maintenance period as well as the Defects Liability Period

5.3 INSPECTION AND TESTING AFTER COMPLETION

5.3.1 General

1. The requirements for issue of the Performance Certificate in this Contract are to satisfy the Employer that the performance of the Works, at the expiry of the Contract Period, meet the requirements of the Performance Requirements and General Engineering Technical Specifications and the Works Performance Guarantees provided by the Contractor as may have been adjusted during the Contract Period.

2. The issue of the Performance Certificate by the Employer will require completion of training and submission of Final Documentation including Operation and Maintenance Manuals, calculations, Financial Cost Model and drawings.

3. Prior to the expiry of the Operation and Maintenance Period, the Contractor shall demonstrate the adequacy of performance by repeating and completing the Tests on Completion as detailed in Sections 5.2 (Sub-Clause 11.1 of Volume 3: Conditions of Contract Part II(B)).

4. The issue of the Hand-over Certificate on completion of the Tests after Completion shall be a pre-requisite of the issue of the Performance Certificate.

5. The Contractor shall demonstrate to the satisfaction of the Employer's Representative that:

   a) the Works is capable of producing the required standard of final effluent and stormwater effluent and that the sludge product, screenings, grit product and any other product meet the requirements of all existing regulations at the time of handing over;

   b) the Works complies with the Employer's Requirements including any agreed changes; and

   c) all Plant and the Works remain suitable for their intended purpose.

6. The Works shall comply at all times with all relevant environmental standards, including but not limited to odour, noise and visual appearance.

7. All items of Plant and systems shall be tested to demonstrate that they operate in accordance with the information provided by the Contractor when operated in both manual and automatic control.

8. The Contractor shall submit to the Employer's Representative fully detailed documentation of his inspection and test procedures to ensure that all requirements of the Contract have been met. Test documentation shall be required for all phases of

testing and must be considered by the Employer's Representative prior to the commencement of testing.

9. Inspections and Tests after Completion of the Works shall be witnessed by persons nominated by the Employer's Representative.

10. No inspection, approval or Statement of No Objection by the Employer's Representative, or his staff, of the Works, Plant or Materials covered by this Contract shall release the Contractor from any of his obligations under this Contract.

5.3.2 Process Acceptance

The Contractor shall be required to demonstrate that the performance of the Works meets the Employer's Requirements and the Performance Guarantees as adjusted during the Operation and Maintenance Period. Sampling and measuring of all relevant performance parameters for the selected process shall include, but not be limited to:

a) Treated wastewater effluent (including recycled stormwater) throughput.

b) Treated stormwater discharge.

c) Thickener dry solids content and polymer consumption (where appropriate).

d) Dewatered dry solids content and polymer consumption.

e) Dewatered sludge output

f) Electrical power consumption.

g) Fuel consumption.

h) Liquor/drainage return quality and throughput.

i) Attainment of odour and air quality control parameters.

j) Noise emission levels.

k) Numbers, frequency and time of day of vehicle movements.

l) Water consumption for both potable and industrial waters.

m) Screenings removal.

n) Screenings washing.

o) Screenings compaction.

p) Grit quality.

q) Primary tank BOD, COD and TSS removal efficiency (where applicable).

r) Treated effluent quality (BOD, COD, SS, Total N, F.coli).

5.3.3 Tests after Completion

1. The Contractor shall be deemed to have completed the Tests after Completion of the Works when all the following have been completed to the satisfaction of the Employer's Representative:

a) the Works has been demonstrated to be hydraulically adequate for the flows at the time of handing over and for the incoming flows rates during the entire period prior to handing over and that the maximum design flow-rate of wastewater can be successfully treated;

b) the Works has been operated for a period of 1 month without breakdown of any item of Plant;

c) the Performance Tests for each process stage of the Works have been satisfactorily demonstrated;

2. The Contractor shall be responsible for any remedial works necessary to achieve the above criteria and shall carry out such work expeditiously at the Contractor's cost.

3. On completion of the Tests after Completion, the Employer's Representative shall issue the Performance Certificate. (Sub-Clause 12.9 of the Volume 3: Condition of Contract, Part II (B)).

6.0 PROCESS REQUIREMENTS

6.1 GENERAL

6.1.1 Operational Flexibility

The Contractor shall ensure that operational flexibility is given priority in the Wastewater Treatment Plant design by:

- The provision of standby facilities
- The provision of all necessary by-passes to maintain plant operability during maintenance and/or breakdown
- The standardisation of plant components, where practicable, to facilitate interchangeability and reduce inventory of spare parts

6.1.2 Standby Capacity

The Contractor shall provide adequate standby capacity to ensure that operation of the Wastewater Treatment Plant is not compromised in the event of either planned maintenance or breakdown.

6.2 WASTEWATER RECEPTION AT TREATMENT PLANT

6.2.1 Pumping from Denis' Quay Pumping Station

The wastewater from Drainage Areas A and B will be collected at a new pumping station to be constructed at Denis' Quay.

It is proposed that a maximum of 525.6 m^3/hr, equivalent to 146 l/sec (6 DWF), be pumped to Commoge via 400mm OD HPPE PE100 pipe, 2,131 lin.m long, the pipe to be laid under the Civil Contract (see drawing numbers 3505-1100 to 1105). From Commoge, the flow will discharge by gravity into the proposed WWTP at Cappagh.

3 no. foul pumps (2 Duty + 1 Standby) are to be provided. Details are as follows:

• Ground level at PS:	2.35 m OD
• Top of Sump	3.50 m OD
• Invert level of foul sump	-4.25 m OD
• Discharge level of rising main	1.34 m OD
• Rising main	400 mm OD HPPE PE100, SDR17
• Length of rising main	2,131 lin m
• Highest I.L. on route:	3.90 m OD at Ch. 145m

Variable-speed pumps shall be provided, any two of which shall be capable of catering for a flow of 146 l/s (6 DWF), and capable of passing a sphere of 100mm diameter. Each pump will be capable of pumping in excess of 3 DWF (73 l/sec) when operating on its own. The pumps will operate in a 'Duty + Duty Assist + Standby' mode."

This pumping station, pumps and the rising main from Denis' Quay will be installed under a separate contract and do not form part of the Design Build Operate Works. The rising main will terminate at Manhole F397. See Drawing 3505 1025.

6.2.2 Flows from Drainage Area C

Flows from Drainage Area C will be collected and delivered to Manhole F397. See Drawing 3505 1025.

6.2.3 Final Manhole (F400)

From Manhole F397, the combined flows will be conveyed by a 750mm diameter sewer to Manhole F400 adjacent to the Wastewater Treatment Plant Site. This sewer and Manhole F400 will be constructed under separate contract. The Contractor will be responsible for connecting to

Manhole F400 and for conveying all wastewater from this point to treatment and thence to the outfall pipe.

6.3 INLET PUMPING

A new Inlet Pumping Station shall be provided, at a convenient location on the wastewater treatment plant site, close to Manhole F400. The capacity of the pumps shall be sized so that they have a capacity of 253 l/s at full speed in operation and shall take full account of the criteria shown in Table 5: Wastewater Treatment Plant – Design Flows and Organic Loads

6.4 INLET WORKS

The inlet works shall be designed to cater for the full flow of 253 l/s and shall include, but not be limited to:

- Screening
- Grit Removal
- Fats, Oil and Grease Removal
- Septicity Treatment (if required)
- Stormwater Management

6.4.1 Screening

1. Screening equipment shall be installed within a building or enclosure. The screens shall have apertures not exceeding 5 mm in either direction. The design velocity through the apertures shall not exceed 1.2 m/s.
2. The screens shall be equipped with an automatic cleaning system to prevent blockage. The screen cleaning system shall be operated intermittently and shall be controlled by both an adjustable timed cycle and a pre-set difference in head across the screen.
3. The screens and screening handling equipment shall be selected from suppliers with a proven track record for this application.
4. A minimum of two screens (one duty one standby) shall be provided. Each screen shall have the capacity to handle maximum flow. Each screen shall be automatically brought into operation, as required. A means of isolating each screen with penstocks capable of manual operation shall be provided.
5. An emergency bypass channel (or other similar type facility) capable of transferring the full flow shall be provided. This by-pass channel shall be isolated by a penstock which shall also act as an emergency overflow weir. The Contractor shall specify the design headloss before an overflow occurs. The bypass channel shall be equipped with a manually raked bar screen with a bar spacing of 10 mm.
6. Screenings shall be macerated, washed and compacted, or equivalent, to achieve a minimum dry solids content of 30%. The compacted screenings shall be free of faecal matter. The Contractor shall specify the guaranteed level of organic content in the screenings. In order to minimise nuisance, the screenings shall be bagged. Handling and collection of the screenings shall be conducted inside the screening building. The screenings handling plant shall be capable of treating the peak screenings loads, which may occur following a storm. The Contractor shall demonstrate that this has been taken into account in the design of the screenings handling system.
7. The used washwater shall be returned to the main wastewater stream for treatment.
8. Transport and disposal of screenings shall be the responsibility of the Contractor.
9. All screen headworks shall be enclosed and vented. The extracted air shall be provided with odour treatment. The screenings handling route shall be covered and the air from beneath the covers shall be vented to the odour treatment plant. Suitable materials shall be used to resist corrosion.

10. Screenings shall be removed from the site in sealed containers designed to prevent release of odours or liquid to the environment along the route to the ultimate disposal location.

11. Provision shall be made for storage of empty containers/bags inside the building.

12. The Contractor is responsible for the disposal of all screenings.

6.4.2 Grit Removal

1. All flows arriving at the plant shall pass through the grit removal facilities. The grit separators shall be located in the screenings building downstream of the screens. The grit separators shall be capable of removing at least 95% of particles with a specific gravity of 2.65 g/cm^3 and with a diameter of 0.2 mm and greater.

2. Hydrodynamic circular grit separators or conventional cross-flow type separators are preferred. Aerated grit separators may also be used provided that a successful performance for grit removal efficiency and ability to remove the accumulated grit from the bottom of the separators can be demonstrated.

3. Grit removed by the separator shall be washed. The washing system shall be designed to achieve an organic matter content less than 10% of the dry solids content measured on a w/w basis. The wash water from grit washing shall be returned to the main inlet flow.

4. Grit separation, grit handling and collection shall be carried out inside the screenings building. The units shall be covered and the extracted air shall be directed to the odour treatment plant.

5. Transport and disposal of grit shall be the responsibility of the Contractor and the facilities shall be designed to prevent release of odour and liquid to the environment.

6. Provision shall be made for storage of empty containers within the building.

7. The Contractor is responsible for the disposal of all screenings.

6.4.3 Fats, Oils and Grease (FOG) Removal Plant

1. The Design-Build Works shall incorporate fats, oils and grease removal Plant. This Plant shall remove any risk of FOG impairing the operation of the works process units, affecting the performance of the Plant or increasing the operational and maintenance costs.

2. The FOG removal plant shall be selected from suppliers within a proven track record for this application.

3. The method of removal of FOG shall be any type of FOG removal system, provided that it is fully automatic in operation and involves the concentration of the FOG for disposal from the Site.

4. FOG removal may be combined in a single stage with the grit removal process provided it can be demonstrated that FOG removal can be achieved to the required level, without detriment or compromise to the specified grit removal performance and efficiency requirements.

5. FOG removed shall be collected in enclosed skips, or other suitable containers, designed to eliminate leakage and minimise odour release during storage and transfer from the Treatment Works.

6. The Contractor is responsible for the disposal of Fats, Oils and Grease removed at the treatment plant.

6.4.4 Septicity Treatment at the Wastewater Treatment Plant

1. For the purposes of design, the Contractor shall assume that flows arriving at the plant could on occasions be septic and the Contractor shall provide for suitable treatment in

order to minimise operational problems at any part of the treatment process and in particular in all primary treatment and primary sludge treatment processes. If pre-aeration is proposed at least two covered pre-aeration tanks shall be provided. There shall be provision for isolating one tank for maintenance.

2. A minimum of one duty and one standby blower shall be provided. The blowers may be housed within the screen house or other conveniently located building.

3. The headspace of the tanks shall be vented or extracted to the odour treatment system.

4. Any proposals submitted by the Contractor for septicity control shall consider the possibility for oils, fats and grease being separated in any pre-aeration process. The Contractor's proposed system shall be designed to prevent the accumulation of any materials separated from the main flow in pre-aeration tanks.

6.4.5 Stormwater Management

1. The treatment plant shall include for the storage of stormwater in holding tanks with a minimum total capacity to provide 2 hours storage for flows in excess of the 3 DWF flow of 375m^3/h up to the maximum of 6 DWF (750m^3/h).

2. The works are to be designed such that the storm tanks shall be filled from the base without any cascades in order to avoid odour nuisance. All storm tanks shall be fitted with scum baffles.

3. The storm tanks shall be equipped with the ultrasonic level monitoring and control system to inhibit operation of the storm return pumps when the tanks are empty. The rate of water level variations shall be continuously recorded and analysed in conjunction with the flow measurement to the secondary stage to ensure that a premature overflow to the storm tanks does not occur.

4. The Contractor's design shall provide for the return of stormwater to the main flows upstream of the secondary treatment process as soon as the flow arriving at the treatment plant has reduced below the maximum design flow to secondary treatment. The settled sludge can be returned to the sludge treatment stream, provided the storm tank is equipped with a sludge removal system. The flow rate of the combined incoming wastewater and storm water return shall not exceed the pre-set maximum flow to the secondary treatment plant. At least one duty and one standby storm return pumps shall be provided.

5. The Contractor shall ensure that the operation of the storm water treatment system and the return of the storm tanks contents does not cause odour nuisance. Automatic washing facilities shall be provided in order to ensure that, after the tanks are drained, all exposed surfaces are cleaned and that no residual sludge remains in the tanks. Final effluent may be used as wash water.

6.5 PRIMARY TREATMENT (NOT FAVOURED)

1. Primary treatment, where provided, shall be designed for flows up to the peak design flows shown in Table 5: Wastewater Treatment Plant – Design Flows and Organic Loads. The Contractor shall state the percentage reduction in total suspended solids and COD at the design loading rates.

2. Tanks shall have a minimum straight wall height of 3.5m as measured from the top water level to the top of the base and shall provide a minimum retention period of two hours at maximum flow conditions.

3. Each settlement tank is to be fitted with a scum removal system. The system shall be designed to minimise the volume of liquid discharged with the scum whilst providing efficient removal of the scum.

4. The Contractor must decide on the need for covers to be provided to the Primary Tanks in the context of achieving the odour limits at the boundary of the site. Where covers are

provided, adequate height shall be provided under the cover to allow personnel safe access to each tank. Alternative designs which do not provide for personnel access below the cover, shall be constructed with removable panels, such that the whole of the tank surface can be accessed for maintenance and inspection.

5. Automatic desludging systems shall be provided for each sedimentation tank. This shall consist of a programmable variable timed operation of desludging pumps.

6. Desludging pumps shall be positive displacement type pumps (hydraulic power pack pumps are acceptable). A minimum of 50% standby will be required of total desludging pump capacity. Sludge withdrawal via a bellmouth system as not acceptable. Desludging pumps shall be directly connected to the sludge collection hoppers.

7. If lamella-type separators are proposed the spacing between the plates shall not be less than 100 mm and the slope of the plates shall not be less than 55^{O} to the horizontal. A means of automatic cleaning of the lamella plates shall be provided and a scum removal system shall also be provided.

6.6 SECONDARY TREATMENT

1. The biological process shall be based upon technically proven processes that are operating successfully and consistently at existing wastewater treatment plants elsewhere on a similar scale and in equivalent environmental and climatic conditions.

2. The biological process shall be provided in at least two (2) streams, with appropriate bypasses to enable the full flow to be passed through, when one stream is out of commission. All pipework and other equipment shall be designed accordingly.

3. Secondary biological treatment shall be provided for flows up to the design flow shown in Table 5: Wastewater Treatment Plant – Design Flows and Organic Loads.

4. Biological treatment systems shall be designed to achieve a treated effluent standard in accordance with the requirements stated in Table 7: Treated Wastewater Criteria of this Volume. The treatment process shall be capable of treating the range of flows expected from the date of commissioning of the plant up to the design flow.

5. The secondary treatment process shall be designed so as to be easily expandable to cater for future increases in loading and/or retrofitting of nutrient reduction facilities (nitrogen and phosphorus). The Contractor shall indicate on drawings, the facilities necessary to provide for a future increase of 50% of the design BOD load and DWF to achieve the discharge standards in Table 7: Treated Wastewater Criteria.

6. The Contractor shall also submit a further layout showing the required expansion of the plant, to provide for the design loading and to meet a total nitrogen standard of 15 mg/l, and a total phosphorus standard of 2 mg/l expressed as an annual mean.

7. The secondary treatment process shall be designed to maximise energy efficiency. Controls shall be put in place to operate the aeration system in a way which matches the air input to the process requirements.

6.6.1 Activated Sludge Systems

1. Activated sludge systems shall be designed to maximise the settleability of the mixed liquor in downstream clarifiers.

2. Plug flow type systems are the preferred option but consideration will be given to other systems.

3. Selector tanks shall be provided in all cases and systems shall be designed to achieve a stirred specific sludge volume index less than 120 ml/g at a mixed liquor suspended solids concentration of 3.5 g/l.

4. A minimum sludge age of 5 days shall be maintained at a temperature of 20^{O}C and the system shall be designed for a mixed liquor temperature range of 10^{O} – 20^{O} C. Dead

spots shall be eliminated by providing baffle walls and fillets to corners of tanks where necessary.

5. Contractors are required to acquaint themselves with the topography of the site and to consider the impact of wind on the surface of the Aeration basin. A minimum freeboard of 0.75 shall be provided in all aeration tanks.

6. Aeration systems shall be capable of maintaining a dissolved oxygen concentration of not less than 2 mg/l throughout the full volume of the aeration tanks at all times.

7. Suitable arrangements shall be provided for draining aeration tanks. The inlet and outlet channels and/or pipework shall be designed to permit any of the individual aeration tanks to be taken out of service.

8. The reactors shall be designed so that the accumulation of biological foam is prevented. Nevertheless facilities shall be provided for the control of foam at the surface of the aeration tanks. The minimum requirements for such facilities shall be bunded hard standing area for containers of anti-foam complete with dosing pumps and pipelines to deliver anti-foam or water through spray nozzles to all of the aeration tanks. The anti-foam system shall also provide with a water spray.

6.6.2 Secondary Settlement Tanks

Where secondary settlement of the activated sludge is incorporated, the design of the tanks shall be based on either of the following design methods:

1. Solid Flux:

The method to be used in design shall be the modified Water Research Centre (WRC) method described in IAWQ Scientific and Technical Report No. 6, 1997 (Ekama et. al. ISBN 1 900222 03 5), using safety factor of at least 0.8 in determination of the critical solids flux. The Contractor shall state the value of the stirred specific sludge volume index measured at a MLSS concentration of 3.5 g/l ($SSVI_{3.5}$) used in the design. The design $SSVI_{3.5}$ shall not be lower than 120 ml/g.

If the design $SSVI_{3.5}$ of 120 ml/g is used, the design critical solids flux shall not exceed 4.8 kg SS/m^2/h and the design critical underflow rate shall not be less than 0.65 m/h.

The Contractor may allow for solids accumulation in the sedimentation tanks. In this case, calculations on predictions of sludge accumulation shall be included in the Tender Proposals. No more than 20% of the biomass (dry solids) in the aeration tanks shall be allowed to accumulate in the clarifiers.

The applied solid flux, G and underflow rate, U are defined as follows:

$G = 10^3 (Q + Q_r)$ MLSS/A kg SS/m^2/h

$U = Q_r/A$ m/h

Where:

Q is the maximum flow rate of sewage (m^3/h)
Q_r, is the underflow rate (m^3/h)
MLSS is the concentration of suspended solids in the mixed liquor (mg/l)
A is the plan area of the clarifiers (m^2).

2. Upward Flow Velocity:

The upward flow velocity shall not exceed 0.9 m^3/m^2/hr with all tanks in operation and 1.2 m^3/m^2/hr with one tank out of service for maintenance. The minimum hydraulic retention time shall be two hours and the maximum solids loading rate shall not exceed 75kg/m^2/d.

In all cases the following shall apply:

- Settlement tanks shall incorporate rotating bridge scrapers and scum removal systems

- Scum removed from the surface of the tanks shall not be returned with the return sludge
- The inlet pipe shall discharge within a stilling box or diffusion mechanism located at the centre of the tank. Where stilling boxes are used these shall occupy a minimum liquid surface area of 10% of the liquid surface area of the tank. The Contractor's design shall include for a means of removing scum from the stilling box.
- Sludge return pumps shall be capable of returning flows in the range not narrower than 0.5 to 1.5 times the average inlet flow or within the range of 0.3 to 0.7 $m^3/m^2/h$ as an underflow rate where the solids flux design method is adopted.
- The side wall depth of the settlement tanks shall not be less than 4.0m.

6.6.3 Sequencing Batch Reactors

1. Where Sequencing Batch Reactors (SBRs) are proposed, reactors shall operate such that a constant discharge to the outfall pipeline is achieved for the majority of time each day.
2. The operation of each SBR shall be timed to provide a minimum settling time of 60 minutes.
3. The minimum distance between the low water level and the top of sludge blanket level shall be 1.0 metres.
4. Moving weir decanters shall be provided which function under a controlled (but variable) constant lowering rate. The decant device shall also be sized so that it does not draw settled sludge into the final effluent. These systems shall be designed to prevent solids entering the decanting device during the aeration phase. Fixed subsurface devices will not be permitted. SBRs shall be fitted with scum removal systems to prevent surface scum and floating material from exiting with the treated effluent.
5. Under normal operating conditions, the buffer zone between the settled sludge and the lowest decant level shall be at least one metre. The surplus sludge pump discharge rate shall be such that excessive amounts of water are not drawn into the sludge treatment system.
6. Aeration of SBR systems must avoid over and under aeration in order to minimise the energy used for aeration. A system of automatic control of aeration shall be provided. A mixing system shall be provided if the SBR is to be operated in react mode without aeration.
7. A maximum aerobic sludge loading rate of 0.12 kg BOD/kg MLSS.d shall be used when operating at a mixed liquor (ML) temperature of 12°C and shall be appropriately reduced if the design SSVI exceeds 120 ml/g.
8. The operation shall be fully automatic to maximise control of energy and to optimise sequencing of all activities between reactors.
9. Dissolved Oxygen (DO) in the mixed liquor shall be at least 4 mg/l for the final 10% of the aeration period to encourage growth of ciliate protozoa.
10. The SBRs shall be designed to operate in a batch mode of operation and wastewater feed shall not occur during the settle or decant phases of operation.

6.6.4 Biological Aerated Filter Type Processes

1. Where Biological Aerated Filters (BAFs) are proposed, they shall incorporate dedicated tanks for dirty wash water and for final effluent to be used in the backwashing stage. The inlet and outlet valves or penstocks for treated flows, backwash final effluent, process air and air scour shall be electrically actuated for automatic control.
2. The initiation of backwash shall be on the basis of time and headloss across the filter. The monitoring of process/air scour air shall be extensive with pressure, flow and blower

availability being high priority alarms. Blower configuration shall include standby for both process and air scour of not less than one spare unit.

3. The operation shall be fully automatic to maximise control of energy and to optimise sequencing of all activities between the filters. The control system shall ensure that adequate units shall remain operational during backwashing, such that design hydraulic and organic loading limits are not exceeded in the remaining operational filters. The design shall ensure that filter effluent quality immediately following the backwash operation is of effluent discharge standard, or is recycled until of dischargeable quality. When recycled, the flow and load to the remaining units shall not exceed the design requirements to be stated by the Contractor.

4. The filter loading, based on average applied BOD load, shall not exceed 1.8 kg BOD/m^3.day when operating at a wastewater temperature of 12^oC.

5. The system shall be designed to minimise loss or carry-over of the media into the treated effluent. The Contractor shall state the anticipated level of media loss, and shall include a cost for replacement. The loss of media shall not exceed 3% total per year.

6. The Contractor shall have a Quality Assurance programme for the sampling of the media, during construction, to ensure that the media conforms to the specification.

7. The filter units shall be fitted with retractable covers in order to ensure that the odour control system deals with the smaller volume of foul air under the cover and, if the units are located in the open, the malodorous air does not escape to the atmosphere.

6.6.5 Rotating Biological Contactors

1. Where Rotating Biological Contactors (RBCs) are proposed the RBCs shall be arranged in at least two independents sets of RBCs working in parallel.

2. Loading rates to RBCs shall not exceed 5g of soluble BOD/m^2d, expressed in terms of the total surface area of media, free and immersed for settled wastewater or 7.5g total BOD/m^2 for raw wastewater.

3. The speed of rotation of the RBCs shall not exceed 0.5m/s. However the rate of rotation shall be such as to prevent settlement of solids in the aeration tank.

4. The RBCs shall have shafts, bearings and self-start motors with sufficient strength to overcome any weight imbalances on the RBCs.

5. Scrapers between the discs may be used to prevent deep biofilm deposits on the discs.

6. The Contractor shall submit full specifications for all elements of the design for the approval of the Employer.

6.6.6 Other Biological Treatment Processes

Where biological treatment processes, other than conventional activated sludge, are proposed the Contractor shall submit full specifications for all elements of the design for the approval of the Employer.

6.6.7 Aeration Systems

1. Aeration systems shall be designed to maximise oxygen transfer and to react to the changing oxygen demands in biological treatment systems. Consideration should be given to the separation of aeration and mixing mechanisms in aeration tanks where appropriate to maximise energy efficiency. Tapered aeration in plug flow systems shall be provided. Combinations of aeration systems will be permitted in plug flow or modular designs. The Contractor shall state the turndown ratio of blowers and any other proposed aeration devices.

2. Aeration systems which incorporate blowers shall comprise at least 3 blowers. Blowers shall be capable of delivering maximum air requirements with the largest single unit out of service.

3. Duty blowers, diffusers and piping shall be capable of delivering at least 150 per cent of the air requirements based on the maximum design loading. The maximum air flow in pipework shall not exceed 15 m/sec.

4. Provision of a system for condensate draining and flushing of the air system is required. Pressure tappings shall be provided to monitor pressure drop for each air valve.

5. Where fine bubble diffused air (FBDA) systems are proposed membrane type diffusers shall be utilised. Ceramic diffusers are not permitted. The Contractor shall state the following:

   - Minimum and maximum capacity of the diffusers at the operating liquid depth
   - Number of diffusers in aeration zones

6. Jet aeration systems shall be designed to provide a minimum liquid recirculation rate capable of pumping the total volume of a reactor in 90 minutes. Manual back flushing systems shall be provided for all jet aeration systems.

7. The Contractor shall provide full details on the performance characteristics of proposed aeration devices. The details required shall include:

   - Standard oxygen transfer rates (kg O_2/h) at the chosen reactor depth carried out in accordance with 'A Standard for the Measurement of Oxygen Transfer in Clean Water' as published by the American Society of Civil Engineers (ASCE) or other equivalent European or internationally recognised standard procedure.
   - Alpha factor assumed for wastewater at various stages in the process for plug flow or modular designs.
   - The overall standard oxygen transfer efficiency (%)
   - The standard aeration efficiency (kgO_2/kWh)

8. The Contractor's design shall be such that it is feasible to carry out performance testing of the aeration system on a full scale section of the plant in accordance with the requirements of other Volumes of this Specification.

6.7 BIOLOGICAL SLUDGE HANDLING, TREATMENT AND DISPOSAL

6.7.1 General

1. The Employer's conceptual design for sludge treatment included for recommendations which resulted from the 1993 National Sludge Strategy Report. These recommendations contained among other things the requirement for primary settlement tanks for wastewater treatment plants with a population equivalent above 5000. Recommendations were also made concerning the level of treatment and storage required where sewage sludge is to be used in agriculture. These recommendations have been superseded and the Employer will take responsibility for the ultimate disposal of the sludge produced on the site.

2. The Contractor's design must at all times comply with the boundary conditions as envisaged in the EIS. For this reason sludge treatment systems which include lime stabilisation or composting will not be allowed. There are issues associated with dust and odours from these types of systems which were not addressed in the EIS and are therefore not allowed.

   Primary Sludges

   Primary sludges from the primary sedimentation tanks (where provided), shall be thickened prior to treatment. Thickening/consolidation tanks shall be designed, such that when operating in series with the sedimentation tanks, the thickened sludge shall have a minimum dry solids content of 6%.

Tanks shall be covered and the air extracted for treatment. The solids loading rate for thickening consolidation tanks shall not exceed 110 kg/m^2/d for primary sludges. The sidewall depth from the effluent weir shall not be less than 4 m.

Where picket fences are fitted to tanks, the peripheral speed of the picket fence shall not exceed 3 m/min. Spacing of tines shall not exceed 400 mm.

Thickening/consolidation tanks shall be fitted with sludge blanket detection system. Tanks shall be designed to provide a minimum hydraulic retention time of 1 day at maximum daily sludge flow rates.

Batch consolidation tanks shall be fitted with a monitoring system to ensure sludge removed from the tank meets the 6% dry solids requirement and minimises solids in the decant.

The Contractor's design for primary sludge thickening shall consider the possibilities for flotation occurring in the thickening tanks due to the nature and composition of the wastewater. Mechanical systems will be acceptable for primary sludge thickening subject to compliance with the boundary conditions described in the Environmental Impact Statement.

Secondary Sludges

Sludges produced in secondary biological treatment processes shall be thickened to a minimum dry solids content of 5% by gravity belt thickeners, centrifuges or flotation systems prior to dewatering.

The Contractor shall provide full details of his proposed systems for thickening secondary sludges including details of energy requirements, chemicals usage, and service life of major components (i.e. filter belt cloths, etc.). Co-thickening with primary sludges is not acceptable.

6.7.2 Sludge Storage

1. Sludge storage facilities shall be provided for the following:
   - Thickened primary sludges (if appropriate) and
   - Secondary sludges.
2. Sludge storage facilities are intended for emergency use only to provide for maintenance or breakdowns of mechanical thickening or dewatering plant.
3. The Contractor shall provide separate tanks for storage for 4 days production of thickened primary (where applicable) and 4 days production of secondary sludges at maximum design loading.
4. Sludge storage facilities shall be covered and the headspace extracted to the odour treatment plant.
5. The required available sludge storage capacity is emergency storage capacity and is in addition to the storage capacity required for the normal operation.

6.7.3 Sludge Dewatering

1. Mechanical thickening and dewatering plant, and associated pumps shall be arranged in at least one duty stream and at least one additional stream of the same size as the duty stream. The duty stream(s) shall be sized to handle at least the average daily sludge quantities over not more than 12 hours per day. The additional stream shall be used to treat the peak loads and serve as a standby during average loading.
2. Polyelectrolyte solution preparation and dosing systems shall be provided for all mechanical devices used for sludge thickening and dewatering. Duty and standby dosing units shall be provided.
3. The minimum acceptable dry solids content following dewatering shall be 20%.

4. Dewatering systems shall be fully enclosed and located in a sludge dewatering building.
5. Automatic systems shall be provided to monitor filtrate/centrate quality.
6. Where belt presses are proposed filtrate or treated effluent shall be used for belt washing except during start-up.
7. Where centrifuges are proposed, controls shall be put in place to adjust the differential speed of the bowl conveyor.
8. Dewatered sludge shall be conveyed to skips by a system of enclosed conveyors. The design shall incorporate a means of purging the conveyor system during downtime on the dewatering plant.

6.7.4 Return Liquors

1. Liquors generated during sludge treatment shall be returned for treatment in such a manner that any adverse effect of shock loads on treatment process is avoided.
2. Wastewaters from any proposed chemical odour treatment systems shall be stored and mixed and shall be gradually discharged to treatment provided their pH is within the range 6.0 to 8.5.

6.7.5 Sludge Disposal

Sludge which has been dewatered to a dry solids content of not less than 20% shall be transported by the Contractor to a site to be designated by the Employer, not more than 50km from the WWTP site for reception and disposal by the Employer.

6.8 VENTILATION AND ODOUR TREATMENT

All treatment buildings shall be ventilated and the air vents scrubbed to prevent odour nuisance. All external doors from treatment buildings shall be fitted with a sensor to provide a recordable signal at the Central Plant Control System, which indicates the status of the door. An alarm shall be raised when any such door has remained open for more than 30 minutes (adjustable). Where feasible any accesses from the process areas shall be by means of a double door system which will act as an airlock. Where practical, the Contractor shall cover individual treatment units and ventilate the head space, passing the air to a scrubbing system.

6.8.1 Ventilation

1. The design of the ventilation system shall ensure that air pressures inside the buildings are negative with the lowest values under the treatment unit covers.
2. Electrical control rooms and switch rooms shall be provided with mechanical ventilation and where appropriate air conditioning systems which maintain the rooms at positive pressure with respect to adjacent process areas.
3. Any accesses from the process areas to electrical rooms shall be by means of a double door system which will act as an airlock. The design shall also prevent surface condensation which may otherwise cause corrosion.
4. Each blower stage in the ventilation system shall be supported by a standby unit, with automatic starting at failure of a duty machine.
5. To limit power consumption and minimise the risk of noise nuisance, the velocity of the air through the ventilation ducting shall not exceed 12 m/s.
6. The ducting shall be manufactured from suitably resistant material. Galvanised steel will not be acceptable.
7. The Contractor shall specify the assumed air change rates for buildings and process units. The rates shall be sufficiently high so that the risk of corrosion is minimised.
8. Mechanical ventilation of buildings shall meet the following requirements:

Building Area	Ventilation Requirements
Switch, control rooms	Minimum 8 air changes per hour and a max temperature rise of $2^{O}C$.
Offices	Minimum 2 air changes per hour.
Storage Areas	Minimum 2 air changes per hour.
Preliminary Treatment Building	Minimum 2 air changes per hour and max. H_2S concentration of 50 ppb.
Blower House	Minimum 2 air changes per hour.
Sludge Building	Minimum 2 air changes per hour.
Workshops	Minimum 8 air changes per hour.

Table 10: Ventilation of Building Areas

9. The following air change rates for the process units (under covers) shall be employed:

Process Area	Ventilation Requirements
Screens and grit separators	Minimum 8 air changes per hour.
Pre-aeration tanks	Negative pressure to be maintained, air extraction rate equal to aeration rate plus minimum 4 air changes (based on head space).
Primary sedimentation tanks	Minimum 2 air changes per hour.
Gravity thickeners	Minimum 6 air changes per hour.
Tanks with variable water level	Minimum 2 air changes per hour on an empty tank or minimum 100%, maximum 150% of the maximum tank fill rate, whichever is greater.

Table 11: Ventilation of Process Areas

6.8.2 Odour Treatment

External Odour Levels:

The plant shall be designed to ensure that the odour release is minimised. Cascading flows shall be avoided and cleaning systems for sumps and chambers shall be provided.

Odour will be controlled by biological or chemical treatment to such an extent that 95 and 98 percentile concentrations of odour of less than 1 and 2 OU/m3 respectively above background levels at the boundary of the site measured in accordance with IS EN 13725:2003 Air Quality – Determination of Odour Concentration by Dynamic Olfactometry and that the hydrogen sulphide concentration at the exhaust stacks of the odour control units shall not exceed 2 ppb and at any one of the four measuring points at the boundary of the treatment plant site does not exceed 0.5 ppb H_2S as H_2S.

The Contractor shall conduct an odour dispersion study for the proposed design. The study shall provide the information on maximum allowable emission rates (OU/s) that may be discharged in the air from the stack while complying with the guarantee.

The following criteria shall be used in the dispersion modelling:

- The meteorological data shall be obtained from the Meteorological Office and comprise hourly-average values for the most recent period of 5 years or more.
- The short-term odour concentrations at the receptor positions shall be assumed to be a factor of ten greater than the hourly-averages predicted by the dispersion model. It

follows that the maximum allowable hourly-average odour concentrations at the receptor positions shall be a factor of ten less than the guaranteed short-term average values.

- The modelling shall take account of the presence of the site buildings, the topography of the site and surrounding area and the proximity of the coast.
- The maximum elevation of the stack top shall comply with the EIS.
- The maximum allowable odour emission rate, E (OU/s) in the stack shall be converted to a short-term hydrogen sulphide concentration, C_s (ppb), in the stack gas using the following formula:

$$C_s = C_t \quad \frac{E}{U\,K}$$

Where: C_t is the threshold concentration of hydrogen sulphide, which shall be 0.5 ppb

U is the flow rate of the air from the stack (m^3/s)

K is the ratio of the total odour concentration of the stack air to the odour concentration contributed by the H_2S in the stack air.

- The value of K will depend on factors such as the composition of the source odour and the design of the scrubbing equipment. A value of 5 shall be assumed unless the Contractor can justify an alternative value acceptable to the Employer's Representative.
- The short-term concentrations of hydrogen sulphide in the stack gas shall be automatically and continuously monitored and periodically recorded. The upper 98 percentile value of these readings shall be less than the value of C_s calculated.

Internal Odour Level:

The concentration of hydrogen sulphide and carbon monoxide in the air inside buildings within the boundary of the site may be measured by the Employer at any time using hand-held instruments. The concentration of hydrogen sulphide shall comply with the guarantees. The concentration of carbon monoxide shall comply with Health and Safety regulations.

Buildings shall be ventilated to provide a safe working environment. Plant shall be selected to suit the zoned area. Units may have sealed covers in order to reduce the volumes of air to be deodorised if this offers the most efficient and economic solution.

At all times the odour standards and occupational exposure levels shall not be contravened.

6.8.3 Odour Treatment Plant

1. Odour control facilities shall be provided for buildings, tanks and process plant where required to minimise toxicity, hazardous conditions and odour nuisance.
2. The Contractor shall propose the most economic system to achieve the specified duty.
3. The ventilation stack shall be installed and fitted with duty/standby ventilation fans and ancillary ductwork. Isolation dampers shall be provided to allow either of the fans to be maintained.
4. A blow down system shall be incorporated.
5. Air extracted from the buildings and tanks may contain concentrations of flammable gases, and fans shall be of spark-proof design to prevent explosions.
6. Tanks and sumps shall be fitted with one way inlet vents.
7. All ductwork shall be designed to be laid with falls and be complete with valves situated at low points to enable condensation to be drained. Ductwork should generally fall back to

the extraction point to ensure that condensed water returns to the tanks from which odour is being extracted. The ductwork shall be designed to ensure that the total number of drain points is minimised.

8. The ductwork installations shall be designed to avoid trapping of fumes or gases in dead ends and prevent the collection of condensation which may be formed internally at any point in the ductwork and which cannot be drained.

9. Ductwork shall be supplied with connections for instrumentation and gauges as required.

10. Appropriate gas sampling points shall be supplied in ducting running from each major leg at a distance of not less than four duct widths from any bend. Ports for manual sampling shall have a minimum diameter of 30 mm. Removable plugs for each of the sampling ports shall be supplied.

11. All interconnecting ductwork shall be manufactured in GRP or other suitable plastic material. Particular attention shall be given to the provision of adequate and sufficient supports for plastic ducting, together with adequate provision for thermal expansion.

12. Hydrogen sulphide shall be monitored in the inlet and outlet ducting to the odour control plant. Sampling points for the gas monitoring equipment shall be designed to allow manual sampling and shall be located in straight legs of ducting not less than four duct widths from any bend or other transition.

13. The hydrogen sulphide monitors shall provide a 4-20 mA signal for monitoring of the air for H_2S levels by the SCADA system via the local MCC PLC.

14. The Contractor shall provide an air flow meter to measure the air flow rate to the odour control plant and shall provide a 4-20 mA signal for connecting into the SCADA system via the local MCC PLC.

6.9 CHEMICAL HANDLING SYSTEMS

1. All chemical solutions shall be prepared and dosed automatically. Dosing shall be related to the demand in order to minimise consumption of chemicals. Adequate mixing and dispersion of the chemicals in the medium shall be achieved.

2. Storage capacity for chemicals used at the plant shall be sufficient to enable the plant to be operated for one month at maximum throughput. All storage tanks for chemicals shall be bunded (bund capacity to be at least 110% of storage tank capacity) and any spillage shall be diverted to the return liquor stream.

3. Where polymers are used for conditioning of sludges, the polymer make-up system shall be suitable for the sludge type, specified sludge throughput and the type of the mechanical device. The systems shall comprise make-up units transfer pumps, polymer storage and dosing pumps operated on a duty/standby basis.

4. Potable water shall be used for initial dilution of the polymer. Treated final effluent may be used to prepare the final dosing solution.

5. The polymer make-up system shall be supplied complete with all necessary pipework, valves and instrumentation.

6.10 ULTRA VIOLET DISINFECTION SYSTEM

1. The general requirements for the Ultra Violet Disinfection System are included in Volume 10 of these documents.

2. The Contractor shall design and install an Ultraviolet Disinfection System which is capable of ensuring that the treated effluent meets the requirements of Section 3.3.2 Treated Wastewater Quality.

3. The Ultra Violet Disinfection System shall be selected from suppliers with a proven track record for the effective disinfection of secondary effluent and must be compatible with the proposed biological treatment process.

4. An adequate spare parts inventory shall be maintained such that down-time is minimised. The minimum number of spare lamps shall be at least 50% of the total number of lamps installed.

5. The entire installation shall be arranged to minimise the possibility of accidental damage or unauthorised access.

6.11 FINAL EFFLUENT WASHWATER AND POTABLE WATER DISTRIBUTION

1. The Contractor shall provide a pressurised washwater booster system (clearly identifiable and separate from the potable water distribution system) to supply final effluent as required throughout the works. The system shall include, but not be limited to, duty/standby submersible pumps, pressure vessel and a dual filtration unit to allow replacement of one of the filter elements whilst the other element is operational. Automatically backwashed filters shall be provided.

2. The Contractor shall also provide a separate booster set to supply potable water to the potable washwater ring main. This water shall be drawn via a break tank, from the mains feed to the site.

3. The potable water booster set pumps shall be two (duty/standby) vertically mounted, multistage, centrifugal types with close coupled electric motors.

4. The booster sets pressure vessel shall be of steel construction fitted internally with a removable synthetic rubber bladder type diaphragm. The vessel shall be fitted with a self sealing valve connection for charging the space between the wall of the vessel and diaphragm, with air to pre-charge the diaphragm to the pressure requirements of the system.

5. Pressure gauges complete with isolation valves shall be provided and fitted to the delivery line and booster set pressure vessel.

6. Separate suction pipework shall be provided for each booster set pump complete with isolation valve, non-return valve and strainer.

7. Final effluent water and potable water shall be provided to all Plant and Materials requiring washing down or flushing and to polymer dosing plant. The Contractor shall identify potential points of spillage and shall provide the hose points for washing down within buildings and areas where sludge or liquor spillage may occur.

6.12 FLOW MEASUREMENT AND SAMPLING

6.12.1 General

1. The Contractor shall provide sufficient measuring devices and sampling equipment to comply with the requirements of this specification and for the proper operation and maintenance of the plant.

2. Flow measurement and sampling shall be provided for the following purposes:

   - Estimation of the incoming wastewater flow rate and pollutants load for payment purposes
   - Estimation of the quality and quantity of flows discharged to the outfall for compliance purposes
   - Estimation of operational loads onto the particular process units for process control and operation
   - Measurement of the weight and dry solid content of imported sludges.
   - Estimation of the quality of the discharges to the atmosphere for compliance purposes

- Confirmation of the odour levels at the boundary of the site for compliance purposes

6.12.2 Flow Measurements & Sampling Points

Flow Measurement and sampling shall be provided, as a minimum at the points shown in the table below. The Contractor is free to install any additional flow measurement and sampling he may choose.

Location	Flow/Weight Measurement	Sampling Point	Reference
Incoming Wastewater	✓	✓	A
Flow to the storm holding tanks	✓	✓[A]	B
Overflow from the storm tanks	✓	✓[A]	C
Flow to the secondary treatment plant	✓	✓[A]	D
Final effluent	✓	✓[A]	E
Return activated sludge (RAS)	✓		F
Surplus activated sludge (SAS)	✓	✓	G
Combined thickened sludge to sludge treatment (if Primary Settlement included)	✓	✓	(H)
Final sludge produce	✓	✓	J
Odour control plant outlet stacks		✓	At each stack
Odour at the site boundary receptor sites		✓	At 4 points along the boundary to be agreed
Total flow to outfall		✓	K
Potable water	✓	N/A	L

Table 12: Flow Measurement and Sampling Points

Note: [A] Indicates that automatic sampling required.

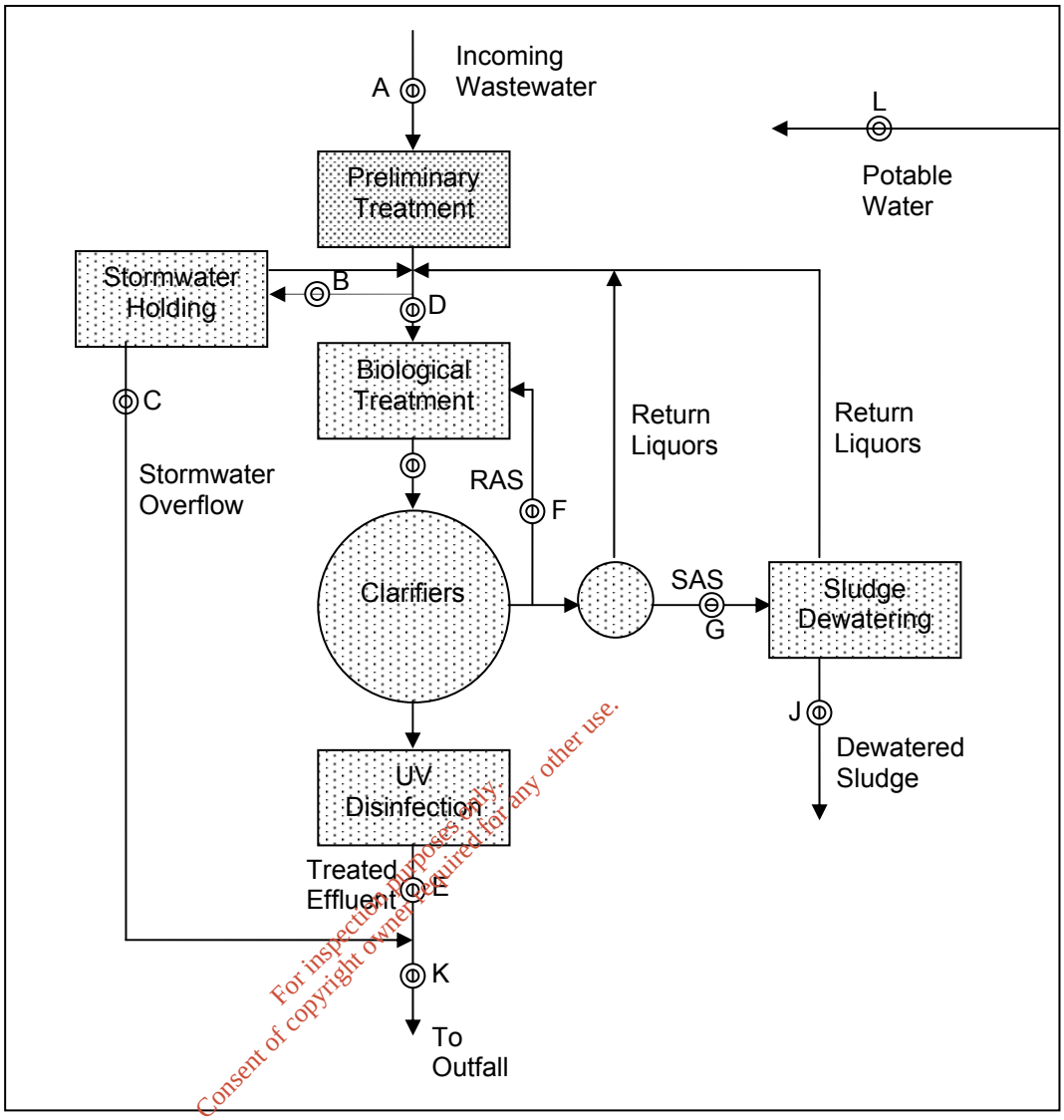


Figure 1: Location of Sampling Points

6.12.3 Flow Measurement

1. Flowrates used for payment purposes shall be measured with open channel flumes fitted with ultrasonic level devices, rather than electromagnetic flow meters. In other areas where electromagnetic flow meters are utilised, the Contractor shall ensure that the meters are suitable for easy calibration to be conducted on site.
2. Flow measurement carried out using flumes shall be designed, provided and calibrated in accordance with BS 3680 Part 4C.

6.12.4 Sampling

1. For sampling points which are directly connected to the process guarantees or payments, refrigerated automatic samplers shall be permanently installed. Provision shall be made for retention of samples without deterioration during periods when the plant is unmanned (weekends, holiday weekends etc)
2. Final effluent automatic samplers shall be flow or time proportional.
3. All automatic samplers which are utilised for determination of the loads for payment purposes shall be capable of collecting flow proportional composite samples.

6.13 LABORATORY AND ANALYTICAL EQUIPMENT

1. The Contractor shall provide a laboratory equipped with analytical instruments, furnishings and equipment necessary for testing of wastewater and sludge samples taken at the works.
2. The laboratory shall as a minimum be capable of carrying out testing for BOD, COD, SS, total Nitrogen, phosphate, determination of Dissolved Oxygen, pH, temperature, SSV, SVI, total dry solids, of samples. Equipment shall also be provided for microscopic examination and assessment.
3. The contractor shall ensure that the laboratory is adequately ventilated and that such necessary ancillary equipment is provided to ensure a safe working environment for its personnel.

6.14 SERVICES

6.14.1 General

1. The Contractor is responsible for the provision of all utility services, including water, electricity, gas (if required) and telecoms to the site.
2. The Contractor shall liaise with the service authorities to determine what services can be made available to the works and their reliability. The Contractor shall provide all services required for the works allowing for an anticipated increase of 50% in the influent over and above the design values.
3. The Contractor shall advise the Employer's Representative in writing of all arrangements he enters into with the public or private utilities and provide copies of all correspondence between himself and the utilities. He shall give the Employer's Representative adequate notice of all meetings he has with the utility representatives so that the Employer's Representative may attend. He shall minute all such meetings and provide the Employer's Representative with copies.
4. Procedures shall be developed to cater for planned maintenance and for emergency failure of services, such that the environmental standards are not compromised.

6.14.2 Potable Water

1. Potable water shall be distributed throughout the site by means of a pressurised ringmain.
2. The Contractor shall provide a potable water storage facility equivalent to at least one day's storage at maximum usage.
3. All costs including any capital charges or contributions and usage charges shall be met by the Contractor. The Contractor shall arrange for all bills to be to his account.

6.14.3 Electricity Supply

4. The Contractor shall arrange for twin 10kV electricity supplies to the treatment plant, which shall each consist of a minimum size of XPLE cable of 400mm^2. At the wastewater treatment plant the route of the electricity supplies shall follow the line of the access road. One supply cable shall be laid, in a duct, on each side of the access road.
5. The supplies shall be capable of auto-change over in the event of a failure of either supply.

6.14.4 Telephone Supply

The Contractor shall provide a suitable number and specification of telephone cables.

7.0 MECHANICAL, ELECTRICAL & ICA WORKS

7.1 GENERAL

7.1.1 Hazardous Area Classification

The Contractor shall carry out a risk assessment of the possibility of the existence of potentially explosive atmospheres and determine the need for Hazardous Areas Zonal Classification.

All zone classification shall be in accordance with National Rules for Electrical Installations in Potentially Explosive Atmospheres, Part 6.1, 1984.

Any electrical plant or materials shall conform with the Guide to the Selection of Electrical Apparatus for use in Potentially Explosive Atmospheres, Guide G6, 1986 published by the Electro Technical Council of Ireland and the following Statutory Instruments:-

European Communities (Electrical Equipment for use in Potentially Explosive Atmospheres) Regulations:

- SI Nr. 61 of 1981
- SI Nr. 244 of 1986 (Amendment)
- SI Nr. 355 of 1998 (Amendment)

Plant shall be of an approved type and be rated as “Intrinsically Safe” or “Flameproof” as necessary.

7.1.2 Labels

All labels or signs relating to safety shall conform to BS 5378.

All plant items shall be fitted with a rating plate, which contains as a minimum, the manufacturer’s name, the type reference, the serial number, the date of manufacture and the rating of the machine or plant item.

All plant items are to be fitted with a unique name plate bearing the individual plant reference for the plant item, e.g. “Agitator Motor Nr.4”. In the case of removable plant items, the name plate shall be fitted alongside the item.

In addition each item of plant and equipment shall carry an asset nr. label which may be electronic.

Name plates and rating plates shall be either Traffolyte (black letters on white label) or 316 Stainless Steel labels tamped with black lettering. The lettering shall be of a size suitable for the application, but shall not in any case be less than 6mm high. All labels shall be visible from an operator accessway.

Each switchboard, motor control centre, ICA panel, pump, valve, etc. and all other items of plant and equipment shall be fitted with an identification label with letters not less than 12mm high. Additionally, each individual switch shall have an identification label at both the back and front of the unit, where applicable. These labels shall carry the unambiguous switch name and number, in letters not less than 8mm high, which will denote the service or plant items which they control.

Fuse or MCB sizes and circuit numbers must be clearly indicated adjacent to each device to facilitate identification and replacement.

Where more than one power supply is connected to a distribution board or plant item, clear indication of the danger must be given and the voltage between phases should also be made obvious.

All cables shall be clearly labelled so that their source, estimation and function can be identified.

All labelling or types of labelling will be subject to the approval of the Employer’s Representative before installation.

All pipework above ground shall be labelled with contents and flow direction. Pipework of diameter less than 50mm may have tags or clamped signs unless it is less than 15mm in length where labelling shall not be necessary.

All storage tanks shall be labelled with contents and volume. Letters shall be of a size suitable for the application but shall not be less than 100mm high labels shall be painted at 90 degree intervals at a suitable elevation.

7.2 EMERGENCY STOP EQUIPMENT AND LOCAL ISOLATION

7.2.1 Local Control Stations

Each specific item of electrically powered rotating machinery shall be provided with local start and emergency stop pushbuttons. Where the drive has the capability to run in reverse, separate “Start Forward” and “Start Reverse” buttons shall be provided. The pushbuttons shall be housed in the same enclosure, clearly labelled, adjacent to the relevant access point or machinery.

Where applicable, e.g. screen drive motors; the local control enclosure shall include pushbuttons for “inch forward” and “inch reverse” control.

Emergency Stop buttons shall be of the “Stay Put” type, twist or pull to release, to BS EN 418.

7.2.2 Local Isolation

Each specific item of electrically operated machinery shall be provided with a local isolator. Isolators shall be mounted in accessible locations adjacent to the motor, or for submersible pumps, adjacent to the entrance to the sump.

Local isolators shall have auxiliary contacts to trip and lock out the contractor when the isolator is open.

Local isolators shall be provided in all cases for valve or penstock actuators.

All local isolators shall be suitable for padlocking in both the “on” and “off” positions and shall not be provided for use as an emergency stop facility.

7.3 NOISE

1. The Contractor shall design and construct the works to ensure compliance with the recommendations of BS 5228.
2. With the maximum number of items of plant running on load, the sound pressure outside an envelop of 1m radius from any item of plant shall not exceed 85 dB (A). Where plant is installed in a separate room or enclosure the noise level outside a distance of 1m from the room or enclosure shall not exceed 80dB(A).
3. The Contractor shall erect hazard warning notices indicating that ear defenders are to be worn at the entrances to all rooms or areas where the sound pressure level exceeds 80dB(A).
4. Sound pressure levels shall be measured in dB (A) using a calibrated sound meter meeting the requirements of BS EN 60651 (with a response speed set to slow).
5. Determination of sound power levels and mechanical vibration produced by gears shall be subject to BS 7676-1 and 2.
6. Ear defenders shall comply with BS EN 352-1 ear plugs shall comply with BS EN 352-2.

7.4 FINISHES

Finishes shall comply with the Employer’s Requirements. Alternatively proprietary items such as instruments, motors and gearboxes that are readily available from commercial sources can

be supplied with the manufacturer's finish provided evidence is supplied the Employer's Representative's satisfaction, demonstrating its finish is suitable for the application.

All painting and protection works shall be carried out to BS 5493. Zinc or aluminium sprayed steel components shall be to BS EN 22063.

7.5 SECURITY

1. The Contractor shall provide a suitable security system.
2. All buildings, kiosks and enclosures shall have a security lock.
3. All buildings and enclosures shall be fitted with intruder alarms which shall cover window and door contacts, glass breakage detectors and PIR movement detectors. The alarm system for the site shall be armed/disarmed via a keypad in the administration building. The alarm system for each building shall be capable of being controlled by zone selection.
4. The intruder alarm system shall be designed to BS 4737 and shall be mains powered with battery backing. High risk plant or materials shall be additionally protected by lockable cabinets or other devices.
5. The alarm shall alarm locally (externally audible alarm) and to SCADA where it shall be logged.

7.6 EMERGENCY POWER SUPPLY

1. The Contractor shall provide a gas or diesel generator, permanently connected at the site, as a standby source of power sufficient to operate the treatment plant's essential services during a complete failure of the ESB supplies.
2. The plant shall be capable of safe shut down of all non-essential services and of safe start-up upon restoration of power. The Contractor shall develop procedures and demonstrate how these would be carried out in a safe manner.
3. The Contractor shall research the reliability of the power supplies and the plant through which it is supplied to the works and demonstrate that the emergency power source will work for the duration of a power supply shutdown such that the environmental standards are met.

8.0 ELECTRICAL DESIGN AND CONFIGURATION

8.1 GENERAL

8.1.1 Rules and Regulations

The electrical and ICA installation shall comply with the following regulations and requirements in so far as they are applicable:-

- National Rules of Electrical Installations, Third Edition 2000 of the Electro Technical Council of Ireland
- "Requirements for Earthing in Electrical Installations" of the Electricity Supply Board
- The Factory (Electrical) Regulations 1972
- The Regulations of Local Authorities
- The code of Practice for the Design, Selection and Erection of Low Voltage Switchgear Assemblies 1981
- National Rules for Electrical Installations in Potentially Explosive Atmospheres Part 6.1
- Guide to the Selection of Electrical Apparatus for use in Potentially Explosive Atmosphere G6, 1986

8.1.2 Scope

This section describes the electrical plant to be provided for the works and specifies the particular requirements for the plant not covered elsewhere in the Employer's Requirements. The electrical plant to be provided shall comprise all the necessary works for the completion of all main and ancillary installation, and shall include but not be limited to:

- The necessary power supplies to the site to cater for the plant installation, testing, commissioning, operation and maintenance.
- The necessary equipment and controls to interface with the power supply authority's supply and to transform this supply to meet the requirements of the plant and the power supply authority.
- The necessary generating equipment and controls to provide emergency power in the event of a total or partial power failure on the national grid supply.
- The necessary power distribution equipment, including distribution boards, electrical protection, metering, earthing, cabling and cable support systems for the plant.
- The necessary electric motors, valves and actuators to operate the mechanical equipment being installed at the plant
- The necessary electrical starting equipment, isolating equipment, electrical protection, controls and interlocks for each plant item
- The necessary indoor, outdoor and emergency lighting including al poles, brackets, fixings, etc. for the plant
- The necessary site electrical services including sockets, space heating, ventilation, frost protection etc.
- The necessary uninterruptible power system
- The necessary fire detection and alarm system
- The necessary gas protection and alarm system
- The necessary telecommunications system
- The necessary security system
- The construction phase electrical services
- The necessary materials and accessories to provide a complete electrical installation

8.1.3 Electrical Power System

1. The provision of an Electrical Power Supply to the Plant is wholly the responsibility of the Contractor and all costs incurred in its provision (including payments to the ESB) shall be included in the Tender Price.

2. The Contractor shall arrange for twin 10kV electricity supplies to the treatment plant, which shall each consist of a minimum size of XPLE cable of 400mm^2. At the wastewater

treatment plant the route of the electricity supplies shall follow the line of the access road. One supply cable shall be laid, in a duct, on each side of the access road.

3. The supplies shall be capable of auto-change over in the event of a failure of either supply.

4. The Contractor shall apply formally to the ESB for a construction site power supply and shall indicate the details of the proposed load at the time of application.

5. The Contractor shall tabulate the proposed electrical load for the works and shall submit a detailed application to the ESB for the supply of this load.

6. The Contractor shall ensure that the size of the transformers, busbars and cables used in the ESB supply are adequate for the load being supplied and that they are installed in a manner to provide maximum security of supply and flexibility of operation.

7. The contractor shall establish the capital cost contribution required by the ESB for the provision of the necessary power supplies and shall clearly indicate this cost separately in his tender proposal.

8. The Contractor shall ensure that two incoming power supplies to the site are adequately protected and metered by the ESB and shall provide the space required by the ESB in the switch room of the treatment for the ESB meter cabinets.

8.1.4 Electrical Power System Design

1. The Contractor shall compile a schedule of the electrical loads at the treatment plant. This schedule shall show the total connected load in each category, together with the calculated diversity factor, the probable load and the maximum demand likely to be experienced.

2. This information shall be submitted to the Employer's Representative for review. The Contractor shall design the electrical power system to suit the ratings and duty cycles of the plant items and auxiliary systems which are to be installed.

3. The power distribution shall be designed to suit the following voltages:

   MV = 10 KV initially, 20 KV later

   LV = 400/230/110 volt

4. The Contractor shall select the necessary voltage and current transformers together with suitable protection relays to protect the electrical plant and its distribution system.

5. The protection shall include thermal overload, short circuit, earth fault and single phasing as appropriate.

6. The electrical protection shall be graded so that indiscriminate tripping is prevented under faults or surge conditions.

7. The Contractor shall co-ordinate the work's electrical protection with the ESB system protection and shall submit to the Employer during the design a tabulation to demonstrate the protection settings to be employed and the appropriate discrimination curves for the complete power system.

8.1.5 Plant Ratings

1. All electrical plant whether specified for indoor or outdoor mounting shall be rated for continuous operation at the maximum specified duty load, and at an ambient temperature not less than the maximum anticipated site ambient temperature conditions.

2. Where plant is installed in buildings subject to internal heat gain due to plant power losses the plant shall be rated for maximum continuous operation at the maximum internal ambient temperature limited by the performance of the building ventilation systems, as detailed in the Employer's Requirements.

3. The Contractor shall ensure that the electrical switchgear is rated at not less than the current ratings for maximum load conditions.

8.1.6 Power Factor Correction

1. The power system shall be designed to operate at a minimum power factor of 0.95 lagging at the point of supply with the ESB.
2. Care shall be taken to ensure that harmonic voltages are limited and the Contractor shall consult the ESB concerning the impedance of their supply network at the frequencies most liable to resonance.
3. The power factor correction equipment shall conform to the requirements specified in Volume 9.

8.2 SWITCHGEAR PLANT

8.2.1 General

Medium Voltage Switchgear

The medium voltage switchgear should be designed for operation at 20 KV but shall be connected initially at 10 KV. This is to allow for the conversion of the ESB supply system from 10 KV to 20 KV at a later date (not established).

The Contractor shall ensure that the MV switchgear is designed to accept the ESB power supplies and to distribute the 10 KV/20 KV power to best advantage on the site, when taking into account the location of the 'on-site' generation, and the various power demands, around the site.

The Contractor shall ensure that the MV switchgear is rated for the fault levels likely to be encountered on the site, and the system protection installed.

The Contractor shall ensure that circuit breakers on the MV system are interchangeable where this is possible and logical. The MV switchgear panels shall be suitable for extension at both ends.

An ammeter and kilowatt hour meter shall be fitted to each outgoing circuit breaker panel and the kilowatt hour meter must be capable of delivering energy pulses to a SCADA station.

A kilowatt hour meter shall be fitted to the incoming ESB supplies and these shall be used to verify the ESB power consumption figures. Energy pulses from this kWhr meter shall be suitable for use by a remote SCADA station.

Each circuit breaker shall be complete with manual and motor charged electrical release, spring closing mechanisms.

The spring motor charging release and the shunt trip mechanisms shall be DC operated from a dedicated substation switchgear battery complete with its own monitoring and charging units. The battery monitoring unit shall be linked to the SCADA system.

The motor wound spring mechanisms shall automatically recharge after each operational cycle.

Each MV switchgear panel shall be complete with the necessary voltage and currents transformers, protection relays, instrumentation, circuit breaker controls and indicator lamps.

The Contractor shall ensure that the protection of the MV switchgear is graded to match the ESB circuit breaker protection.

The Contractor shall ensure that the continuity of supply to the works is optimised and the Contractor shall provide all the necessary protection and interlocking systems to achieve this objective.

Low Voltage (LV) Distribution and Motor Control Switchgear

Low voltage (LV) distribution and motor control switchgear shall be of the totally enclosed metal clad pattern and shall comply fully with the relevant clauses.

All LV switchgear shall be designed for indoor floor standing installation and shall be in accordance with IEC 439. All switchboards shall be designed to have busbar and primary conductor assemblies certified for a short circuit strength of 50 KA for 3 seconds.

The LV switchgear shall be designed specifically to suit the plant requirements. Each switchgear unit shall incorporate an incoming 400 volt circuit breaker designed to protect the switchgear unit.

The number of LV switchgear units shall be decided by the Contractor based on the design loading of the plant, the physical location of plant items and the sources of normal and emergency power that is appropriate to ach plant item.

The Contractor shall ensure that each item of plant is provided with an adequate power supply, is equipped with the necessary local and remote control gear and is protected in an appropriate manner.

The following features shall be incorporated into the LV distribution and motor control switchgear where appropriate.

a) Provision for an incoming supply
b) A motor starter compartment for each motor
c) Individual compartments for common control
d) Individual compartments for the PLC and ICA sections
e) 400/230 volt and 110 volt distribution
f) Tool and hand lamp supplies
g) Telemetry marshalling compartment
h) Drawings compartment

Each incoming feeder shall be equipped with a voltmeter, an ammeter and a kilowatt hour meter.

The contactor shall select the starting equipment appropriate to each drive motor and shall ensure that starting sequences are programmed to minimise disruption of the power supplies and maximise plant availability. The starters shall be in accordance with Sections 4 and 7 of Volume 10.

A kWhr meter, with pulsed output, shall be installed on the motor outlet to each motor where the rating exceeds 30kw.

The Contractor shall ensure that provision is included in the low voltage switchgear to interface with the necessary on-site generators and this provision shall include all the necessary control gear, protection and interlocking to enable the ‘on-site’ generators to synchronise and run in parallel with the ESB system.

The necessary volt free contacts and analogue signals shall be provided by the Contractor on each panel for interfacing with the SCADA system.

These shall include:

- Motor Run/Stopped
- Motor Failed
- Motor Selected to OFF
- Motor Selected to MANUAL
- Motor Selected to AUTO

The LV switchgear shall also include all the necessary voltage transformers, current transformers and miscellaneous control equipment to provide a complete unit.

A lamp test button shall be provided on each control panel.

8.2.2 Switchgear Batteries

1. The Contractor shall provide all batteries necessary for the complete operation of all medium voltage switchgear protection and tripping circuits. Separate batteries shall be provided for each substation or plant control switchgear installation.
2. Each battery shall be rated at 110V DC.
3. Batteries shall be provided for the following duties:
   a) Circuit breaker motor charging spring closing mechanisms
   b) Switchgear protection and auxiliary control relay circuits
   c) Shunt trip circuits
   d) Switchboard indicating lamp and alarm circuits
4. Each battery unit shall incorporate battery cells and duplicate chargers housed in a single panel compartment.
5. Supplies for switchgear auxiliary loads energised permanently during normal operation shall not prejudice tripping duty under any operating condition.
6. The battery systems shall incorporate self regulating battery charging plant and failure of either charger or battery output shall initiate an alarm in the associated monitoring system.

8.2.3 Remote Control Stations

1. Remote control stations shall be located adjacent to all rotating plant and equipment, etc. These control stations shall incorporate a motor 'start' push button, and 'emergency stop' push button and a padlockable isolating switch.
2. The motor 'start' push-button shall only operate when the starter Local-off-Remote switch is set to the 'Remote' position.
3. Emergency stop push-buttons shall be provided for all motor drives, adjacent to each motor or drive. The emergency stop push-button shall over-ride all other motor drive controls to ensure immediate motor drive shut down and prevent the drive from being remotely restarted.

8.2.4 Power Transformers

1. The contractor shall assess the power requirements of the works and the requirement to generate and distribute power on the site. The Contractor shall design a power distribution system to meet these power requirements.
2. The design shall incorporate the necessary power transformers to transform power from 10 kV – 20kV/400 volt. Where possible, the size of power transformers should be the same to allow for interchangeability, in a modular form of design.
3. The Contractor shall decide on what type of transformers are used and he shall ensure that these are adequately housed and located.
4. The Contractor shall ensure that the transformers are rated for continuous load operation and full plant load conditions including, where applicable, future loads, at maximum site ambient climatic conditions. The transformer voltage ratios are at 'no-load'.
5. The transformers should be designed to operate at 10 KV initially for a period of some years, after which they will be required to operate at 20 KV. The transformers shall conform to the specification for either oil filled or dry type transformers.
6. The transformers shall be located indoors and the Contractor shall ensure that all the appropriate precautions are taken in the housing of the transformers.
7. Each transformer shall be complete with fittings and the appropriate protection shall be provided to suit the transformer size and type.

8.3 CABLING AND EARTHING

8.3.1 General Cabling

1. This section covers the supply and installation of the necessary cabling and earthing systems not covered elsewhere in the Employer's Requirements.

2. The Contractor shall supply, install, terminate, test, commission and identify all control, protection and instrumentation cabling systems necessary for the operation of the works.

3. HV cables, forming part of the dual supply to the works shall be buried and separated both outside and within the site by at least 2.5m to reduce the possibility of simultaneous physical damage causing a complete power failure to the works.

4. The Contractor shall design the cabling installations in accordance with the Employer's Requirements and shall provide all other additional cables necessitated by this particular arrangement of plant installations.

5. The Contractor shall provide for the consideration of the Employer's Representative, detailed schematic and block diagrams, together with schedules of all cables he proposes to install for power, control and instrumentation systems. The schedules shall include the following information:

   a) Type of cable
   b) Size of conductor
   c) Number of cores
   d) Voltage grade
   e) Cable gland
   f) Cable identification reference number
   g) Cable source
   h) Cable destination

8.3.2 Types of Cables

The following types of cables shall be provided:

a) **MV Power Circuits**
XLPE/SWA/A/PVC, 20000/35000V grade

b) **LV Power Circuits**
For conductor sizes above 10 mm2 XLPE/SWA/PVC, 600/1000V grade
For conductor sizes 10 mm2 or less, PVC/SWA/PVC and PVC/PVC, 600/1000V grade

c) **Auxiliary Control and Protection Circuits**
PVC/SWA/PVC and PVC/PVC, 600/1000V grade

d) **Control and Instrumentation Circuits**
All monitoring and instrumentation shall have individually twisted and screened pairs, a collective screen, PVC/SWA/PVC or polyethylene insulated construction, a minimum conductor size of 1/1.13 mm diam and 400 V grade.

e) **Data Highway**
Optical fibre cables shall be used throughout the data highway interconnecting each PLC with the SCADA system master-stations.

8.3.3 Cable Sizes

1. The Contractor shall size and select power and control cabling to suit the final approved power circuit loading and plant ratings together with the specified protection and plant control and monitoring systems. The Contractor shall replace any cable approved and/or installed and subsequently found to be inadequate.

2. The short time fault current ratings of all power cables shall match the maximum fault ratings of the associated switchgear plant and protection systems.

3. The Contractor shall determine by site investigation the values of:

- Soil temperatures
- Soil thermal resistivity

4. With the exception of special cables for analogue signal and measuring circuits, the minimum core size for auxiliary power and control cables shall be 1.5 mm^2.

5. All multicore cables provided for the plant protection, control and monitoring systems shall incorporate 20% spare cores. All spare cores shall be terminated and identified.

8.3.4 Cable Segregation

1. Power systems operating at different voltages and control, protection and instrument circuits for separate units of plant shall be run in separate cables.

2. For internal cable installations adequate spacing shall be maintained between all power cables to minimise de-rating due to proximity.

3. A minimum of 300 mm spacing shall be maintained between all power and control cables and between MV and LV power circuits.

4. Analogue and DC control signals must not be run in the same cables. A minimum of 600 mm spacing shall be maintained between both analogue and DC control cables and all other cable systems.

5. On external cable routes a minimum of 300 mm spacing shall be maintained between all power and control cables.

8.3.5 Cabling Within Buildings

1. Cable installations within buildings shall be run in the ducts or trenches provided, or installed on or suspended from structural walls or ceilings. Cables in general building areas shall be installed on heavy duty, hot dipped galvanised steel tray. Cut edges of galvanised tray shall be liberally treated with a zinc paint.

2. In all locations of the works affected by wastewater effluent or chemicals creating a chemically corrosive condition, cable tray systems shall be of extruded glass reinforced ultra violet and corrosion resistant polyester (GRP) pattern, of approved type and manufacture.

3. For fixing cable trays in trenches, cable galleries, etc. galvanised steel channel inserts shall be embedded into the concrete, spaced at centres not exceeding 2000 mm. Civil structures utilised to support cable tray systems shall be designed to withstand the additional loading.

8.3.6 External Cabling

1. Separation between cable systems and all other underground services shall not be less than 1300 mm in all directions unless otherwise agreed by the Employer's Representative.

2. External cables shall be contained within ducts unless specifically agreed with the Employer's Representative in advance.

3. In ducted sections of cable route the specified segregation between power and control cables shall be maintained throughout the ducted sections.

4. Buried cables shall be installed with cover depths to the top of the protective tiles of 600 mm for control, monitoring and LV cables; and 1300 mm for MV cables.

8.3.7 Earthing

1. The Contractor shall provide and install a complete earthing system.

2. The system shall be designed to meet the following requirements:

a) Under normal and abnormal operating conditions, there shall be no danger to persons in any place to which they have access;

b) The maximum current from any point of fault shall be conducted back to the electricity system neutral without giving rise to dangerous potential gradients either in the ground or between pieces of apparatus and a person who could be in simultaneous contact;

c) The passage of fault current shall not result in any thermal or mechanical damage to the system.

3. The Contractor shall satisfy the ESB that the earthing arrangements on the electrical installation are compatible with their system requirements.

4. Earth tape and conductors installed in areas subject to chemical corrosion shall be sheathed with green/yellow PVC.

8.3.8 Lightning Protection

A lightning protection system shall be installed in accordance with BS 6651 as specified elsewhere in the Employer's Requirements.

8.4 BUILDING AND SITE SERVICES

8.4.1 Plant to be Provided

1. This section describes the building and site services required at the works and particular requirements not covered elsewhere in the Employer's Requirements.

2. These site services shall include but not be limited to:

a) Distribution boards, conduit and wiring to provide a complete and adequate electrical services installation for the works, including plant buildings and service areas.

b) Building services for all buildings incorporated in the work comprising:
- Interior lighting for all plant and associated buildings
- Small power socket outlets and heating services for all plant and associated buildings
- External lighting for each building
- Ventilation for each building

c) Site services comprising:
- Site roadway lighting
- Area floodlighting
- Access lighting
- Portable site dewatering pump outlet sockets

d) Portable extra low voltage equipment

e) Intruder alarm(s)

f) Site surveillance CCTV

g) Secure access system

h) Fire detection alarm system

i) Gas detection system

j) Telecommunication system

k) Frost protection

3. Materials employed and work carried out shall be in accordance with the requirements of these documents.

8.4.2 Building Services Electrical Power Supplies

1. The power supplies for all building and site services shall be provided from the building services switchboards or otherwise shall be derived from distribution boards which, as far as practicable, shall form an integral part of the main LV distribution and plant control switchboards.
2. Sub-distribution boards not forming part of LV switchboards shall be complete with outgoing miniature circuit breakers for connection to the services and other equipment detailed in this section.
3. At least two spare ways for each type and size of circuit breaker in the distribution boards shall be included.

8.4.3 Socket Outlets

1. Socket outlets shall be correctly earthed and protected by residual current devices.
2. At least one 230 V single phase socket shall be provided in each room and in any case shall be within 15 m of any internal part of a building.
3. At least one 400 V three phase socket shall be provided in each plant area for maintenance purposes.

8.4.4 Heating

The Contractor shall provide for the supply and installation of suitable electric heaters for all site offices, and control rooms and shall detail the proposed heating with the tender. The heating shall be designed to maintain a room temperature of 20^{O}C when the outdoor temperature is 0^{O}C.

8.4.5 Ventilation of Offices

Ventilation shall be provided to maintain a temperature of 22^{O}C in all personnel areas, offices, mess rooms and the control room when the outdoor temperature is 28^{O}C.

8.4.6 Lighting Design

1. Building lighting installations shall be designed in accordance with international standards.
2. The building internal lighting design shall take into consideration:
   a) The operating environment
   b) The type and style of architectural finish
   c) The activities to be performed in the areas concerned
   d) Access for maintenance
   e) Operating life
3. Lighting circuits shall be supplied from the small power and lighting distribution boards incorporating manually reset miniature circuit breakers. For large areas or buildings, separate distribution boards may be provided to serve discrete areas.
4. Switching shall be convenient to doors and entrances, multi-way switching being provided where areas have more than one entrance.
5. For large areas, lighting shall be contactor controlled. Contactors shall where practical be incorporated within the respective distribution boards.
6. In areas housing rotating machinery, lighting shall be arranged on multi-phase circuits to prevent stroboscopic effects.
7. The arrangement of circuits shall be such as to provide balanced loading of the phases.
8. The Contractor shall prepare detailed layout and installation drawings to show the location of the distribution boards, conduit routes, lighting and other fittings, etc. for

consideration by the Employer's Representative, together with illumination level design calculations to support and confirm the proposals.

9. Except in any building where ceiling or wall finishes permit conduit to be concealed the installation shall be carried out in surface run galvanised conduit. All lighting switches, socket outlets, etc. shall be metal-clad surface mounting type.

8.4.7 Standby Generator - Lighting and Small Power Installation

The equipment to be provided under this section shall include but not be limited to the following items, together with conduit and wiring connecting all fittings to their respective distribution boards:

- Distribution
- Essential lighting fittings
- Emergency lighting
- UPS for SCADA system PLC
- Power supplies for fire protection equipment
- Power supplies battery charger
- Any other equipment necessary during mains power supply failure to maintain compliance with environmental performance criteria.

8.4.8 Buildings' Emergency Lighting

1. Emergency lighting shall be provided for all buildings and shall comprise exit and escape route luminaires to facilitate the safe evacuation of personnel from all buildings and structures in the event of power failure and shall be in accordance with I.S. 3217 or equivalent.

2. Emergency lighting shall also be provided in any area where work may be required during such a power failure, e.g. starting of standby generators or other essential plant control operations.

3. The emergency exit lighting luminaires shall be bulkhead fluorescent, non-maintained type, incorporating self-contained battery/charger/inverter modules.

4. Emergency luminaires located above or adjacent to escape doors shall be supplied with "RUNNING MAN" labels.

5. The emergency luminaires shall be directly connected to the respective area main lighting circuits, to cover both total power and sub-circuit failures.

6. Emergency lighting circuits shall incorporate test switches to simulate failure of the normal supply. Test switches shall be situated in a position within the area covered by the lighting system to be tested and shall be suitably identified. Switches situated in positions accessible to unauthorised persons shall be of the tamper-proof, key operated type. All such switches shall be operated by a common key and the Contractor shall supply two keys for each switch installed.

8.4.9 Site Road Lighting

1. Road lighting systems shall be provided to illuminate all site roadways within the treatment plant area.

2. The lanterns shall incorporate high pressure sodium vapour lamps. Lanterns shall be of the side entry inclined overhanging pattern with integral lamp control gear, weatherproof body, and low glare cut-off hood. All site road lighting shall be hooded or cowled and arranged to avoid light nuisance to adjoining properties.

3. The columns shall be 8.00 m high with a 2 m outreach arm.

4. The road lighting shall be fed on independent radial TP&N buried cable circuits fed and controlled from a road lighting switchboard.

5. Each circuit shall be contactor switched, controlled by a photo-cell switching circuit and manual-auto control selector switch. The contactor, time switch and manual control switch for each area shall be incorporated in the LV road lighting distribution switchboard.

6. Photo-cells shall be wall mounted on the south face of the building from where road lighting is controlled.

8.4.10 Site Area Lighting

1. Site area lighting installations shall provide an overall minimum service illumination of not less than 100 lux at locations where plant operation and emergency maintenance can occur.

2. Site area flood lighting shall be fed from service distribution boards incorporated in the respective plant or ancillary switchgear buildings.

3. Site area lighting shall be manually controlled from each respective building and shall be capable of being switched on by a security intruder signal.

4. All external site lighting shall be hooded or cowled to avoid light nuisance to adjoining properties.

8.4.11 Extra Low Voltage Portable Equipment

The Contractor shall provide for each building one set of extra low voltage equipment comprising the following:

1. One gripper type handlamp with wire cage 25V 40 W bayonet cap rough service lamp complete with 15 m of 3-core tough rubber sheathed cable and plug of the same type as fitted to 25V socket outlets.

2. One 500W, 110V, 50Hz weatherproof portable floodlight complete with stand and 15 m of 3-core tough rubber sheathed cable and plug for 110V centre tapped earth socket outlet complying with IEC 209 and colour coded.

3. One 750 VA minimum, triple wound earthed screen step down transformer with 230V, 50Hz single phase primary and two secondary windings one at 110V, 50Hz with centre point earthed of 600 VA capacity and the other 25V, 50Hz, 150 VA capacity. Each winding to be complete with fuses in each lead and housed in a weatherproof enclosure complete with carrying handle. The primary shall be fitted with 2 m of tough rubber sheathed 3-core cable fitted with plug to IEC 309 of the resilient type. Each secondary shall be connected to two integral weatherproof sockets mounted on the enclosure exterior and shall comply with IEC 309 and be colour coded.

4. 2nr. 25 m extension cables, one for 110V and one for 25V fitted with plugs and sockets of the weatherproof type complying with IEC309. Each lead shall be coiled on a self contained carrier.

8.4.12 Fire Detection and Alarm

1. Fire protection and automatic detection and alarm systems shall be provided in all plant buildings throughout the works in accordance with IS 3218, 1989 or equivalent.

2. The fire detection and alarm systems shall comply with the following:

   a) A fire detection system shall be provided in each building comprising automatic fire detectors and manual break glass actuators.
   b) In multiple room or plant area buildings the automatic and manual alarm actuators shall be installed in zoned circuits covering each specific room or area.
   c) The automatic fire detectors shall operate on rate of temperature rise and fixed maximum temperature characteristic; the maximum temperature alarm actuating at $20^{O}C$ above peak design internal ambient temperature. Each detector shall incorporate a pilot lamp operation indicator.

d) Automatic heat and smoke detectors shall be ceiling mounting arranged to cover general building areas and specific plant locations.

e) The manual break-glass actuators shall be wall mounted, located at building entrances, general walkways and corridors and in other areas, such that no location in a building is more than 20 m from an actuator.

f) Alarm/detection installations in ancillary plant buildings may be installed as zoned alarm circuits from the fire detection systems of associated adjacent main plant building.

g) All detector and alarm circuits shall operate on a normally closed fail-safe circuit principle.

h) Each fire detection system shall operate at 12 V DC or 24 V DC from a single control panel which shall be located at a location subject to the consideration of Employer's Representative. The control panels shall be of the totally enclose metal clad pattern each complete with integral battery/charger equipment. The control panels shall each incorporate alarm and status indicators together with circuit test facilities to give visual alarm indication of:
- Actuation of each alarm circuit and zoned protected area
- Input power system – Healthy/Failed
- Battery/Charger output – Healthy/Failed

i) Operation of any fire detector or manual alarm actuator shall operate audible alarm(s) located internally and externally on each building.

j) Alarm system operation together with the operation of a control panel integral equipment fault circuit shall also be annunciated on the SCADA system.

k) All component equipment in the fire alarm installations shall comply with a specification which has been considered by the Employer's Representative. All cable and wiring systems for the building alarm and detection circuits shall be in 400V MICC cable with PVC oversheath. All cable terminations for detector and manual actuators shall be in galvanised circular conduit boxes.

l) Alarm circuits between each plant building and the Central Control Panel shall be by dedicated PVC/SWA/PVC control cables.

8.4.13 Gas Detection System

1. Gas detection systems shall be incorporated into those areas of the works where explosive or toxic atmospheres might occur. These shall include, but not be limited to, the following areas:
   - Sludge thickening and dewatering
   - Sludge wells
   - Enclosed pump wells
   - Sludge pump rooms
2. In addition to any local annunciation the alarms generated shall be displayed on the SCADA system which shall initiate a high extract purge and detection system.

8.4.14 Telecommunications

1. The Contractor shall supply a telecommunication system for the treatment plant. Telephone handsets shall be provided within all buildings.
2. Telephone cables for routes external to buildings shall be multi-pair polythene insulated, 0.9 mm diameter copper conductor, petroleum jelly filled, collectively screened with aluminium tape and copper drain wire, polythene inner sheath, galvanised steel wire armoured and PVC sheath overall. All cores shall be colour coded. All cable interconnections shall be made in termination boxes which shall be installed within the buildings. Underground joint boxes shall not be used. All cables shall incorporate at least 15% spare cores and all cores including spares shall be terminated.
3. Telephone distribution cables wholly within buildings to junction boxes and outlet points shall be similar but unarmoured, and with conductor diameter not less than 0.5 mm.

4. Each telephone handset shall be wired using a 2 pair twisted cable terminated at a telephone outlet point equipped with a faceplate and wiring terminals. All main cable and extension outlet boxes shall incorporate moulded plastic screw fixed termination assemblies. Cable core terminations shall be crimped on spade end pattern or wire wrapped.

5. Telephone cabling within buildings shall be in galvanised steel conduit. The Contractor shall provide the necessary telemetry outstation and equipment to handle analogue and digital signals and communicate with a remote station.

8.4.15 Security System

The Contractor shall provide all the necessary site security systems to detect intruders and raise alarms on site and at a remote site.

8.4.16 Miscellaneous Materials and Accessories

The Contractor shall be responsible for the supply and installation of all miscellaneous materials and accessories necessary to provide a complete electrical installation to conform to the Employer's Requirements.

9.0 INSTRUMENTATION, CONTROL AND AUTOMATION (ICA) EQUIPMENT

9.1 DRAWINGS AND INFORMATION TO BE PROVIDED

The Contractor shall provide drawings and information for this contract in accordance with the time period specified in the Employer's Requirements, which shall include:-

- Functional design specification
- As built drawings
- Drawings for review
- Final documentation and manuals

9.2 PLANT TO BE PROVIDED

The plant to be provided in this section shall comprise all instrumentation, control and automation equipment associated with the new treatment works. The plant to be provided for the works shall include, but not be limited to, the following:-

a) ICA panels complete with all accessories.
b) flow monitoring equipment for all main process streams including wastewater, stormwater and sludge treatment plant
c) dissolved oxygen (DO) monitoring equipment
d) level monitoring equipment
e) pH monitoring equipment
f) composite sampling equipment

In addition, the Contractor shall provide all other monitoring equipment required for the full functional and safe operation and maintenance of the works.

The Contractor shall provide a portable "Employer's Representative's" computer complete with PLC programming software and copies of all PLC programmes. This shall also include all cables required to interface the computer with the PLCs so that modifications to PLC programmes can be undertaken.

All PLCs and monitoring equipment shall operate at 230V, 50Hz and shall be supplied from a UPS such that monitoring of all plant conditions is maintained during a mains power supply failure.

PLCs shall be from one manufacturer and of a common model type.

All plant and equipment and products containing electronics must carry a CE mark to prove its compliance with the EU Directive 89/336/EEC.

9.3 CONTROL ROOM ICA PANELS

9.3.1 General

1. All ICA panels shall be indoor pattern located within the respective plant buildings or in civil structural housings which shall be provided adjacent to outdoor treatment plant.

2. Each local plant MCC shall have an associated ICA panel which shall be manufactured in accordance with the engineering specification. It shall include, but not be limited to, the following equipment and facilities: -

   a) Local PLC, key-pad and display unit
   b) UPS system
   c) Relays as required to interpose PLC I/O with plant control equipment
   d) Alarm annunciator panel to give local indication of those failures not indicated elsewhere on the ICA panel or corresponding MCC. The alarm system repeat contacts shall not be used for alarm inputs to the SCADA system. SCADA inputs shall be discrete.
   e) Pushbuttons, signal lamps, selector switches and indicating instruments and all other necessary plant for the automatic or manual control of plant.

f) Monitoring instrumentation as required for the effective operation and maintenance of the works.

3. For pumps, blowers, valves and penstocks, the controls, signal lamps, switches and indicators shall be mounted on the respective panel as a group for each item of plant.

4. In all cases where a mimic display, duty selection or setpoint adjustment is called for on the PLC system, then this facility shall also be provided on the SCADA.

9.4 ICA PANELS

ICA panels shall be located within control rooms as free standing panels or be incorporated into MCCs as an integral part of the panel suite. They shall comprise, but not be limited to, the following main items of equipment:-

a) PLC system for the control and monitoring of pumps and associated rotating plant and equipment. By means of an associated PLC keypad an operator shall have the facility to select a variety of mimics for presentation on the PLC display unit with the added facility of modifying control set-points. These mimics shall include:-

- Simplified displays of rotating plant and auxiliary equipment, with status, set-point, flow and level indications displays of boilers, dryers, blowers, pumps and associated plant, with status, set-point and variable valued indication.
- A display of the duty for each pump or rotating plant item, with the facility, by use of the PLC keypad, to manually select duty; or to select auto-duty rotation such that the duty of each rotating plant item is automatically changed after a preset time has elapsed.

b) The UPS shall be supplied from an auxiliary switchboard. In the event of UPS failure, or if the UPS is taken out of operation for servicing, then an alternative supply shall be provided from an associated motor control centre.

c) Alarm annunciator shall include those failure indications not displayed at the local MCCs, these generally shall include level monitor failure, high level, primary protection alarms, DO, SS monitor failure, flow monitor failure, temperature failure etc.

d) Process monitoring equipment shall include:

- Dissolved oxygen monitors. The 4-20mA output from these DO monitors shall be transmitted to the PLC to provide control and process monitoring on the SCADA system.
- Pitot tube & DP cells flow measurement. Located within the air pipelines the 4-20mA outputs shall be transmitted to the PLC to provide control functions.
- Ultrasonic flow monitoring. The 4-20mA output from each flow monitor shall be transmitted to the PLC to provide process monitoring on the SCADA system.
- Electromagnetic flow monitoring. The 4-20mA output from each flow monitor shall be transmitted to the PLC to provide process monitoring on the SCADA system.
- Position switches, or linear position transmitters. The digital, or 4-20mA, outputs from these devices shall be transmitted to the PLC to provide process monitoring on the SCADA system.
- Ultrasonic level monitors located within sumps, chambers and tanks. The 4-20mA output from each level monitor shall be transmitted to the PLC to provide a control function. Hard wired detection status shall be provided to the PLC.
- Electrodes or float switches for sumps, chambers and tanks, high level alarm annunciation.
- Pressure gauges, switches, sensors and transducers associated with plant operation and monitoring.
- All other instrumentation required for the full and safe functional operation of the works.

9.5 MV/LV SUBSTATION PLC SYSTEM

A PLC system shall be located within the new MV/LV substation. The PLC system shall collect all those signals associated with the MV/LV distribution switchgear generators and transformers for monitoring and display on the SCADA system. The PLC system shall operate from a 230V, 50Hz supply fed from an associated UPS with a second supply available from the local distribution board in the event of a UPS failure.

9.6 SURGE PROTECTION DEVICES FOR ELECTRONIC EQUIPMENT

All electronic equipment installed shall be protected from electrical transients arising from:-

- Atmospheric lightning
- Electrical switching events
- Electronic equipment

To achieve this, effective protective devices shall be installed on:-

- Mains power supplies
- Data communication and signal lines to limit transient voltages to a level where they can have not detrimental effect

The Contractor shall provide a detailed schedule of the equipment with calculations to the Employer's' Representative for review.

9.7 PLANT CONTROL SYSTEM

9.7.1 Works to be Included

1. The works included in this section shall comprise the design, manufacture, supply, installation of the Plant Control System.
2. This section details the main systems and plant together with the proposed methods of control of the plant installations, and shall be read in conjunction with the mechanical and electrical plant, and measuring equipment sections of the Employer's Requirements.
3. In addition to the supply and installation of the Plant Control Systems, the Contractor shall also be responsible for testing and commissioning as detailed elsewhere in this Volume. As an integral part of the commissioning procedure the Contractor shall ensure, and demonstrate to the Employer's Representative, that all the monitoring, instrumentation and controls systems are adjusted to achieve optimum control of the treatment plant process and/or plant operation and that all control systems are correctly interfaced and operating as a fully integral system.
4. The Plant Control System and main items of plant to be supplied shall include:-
    - Supervisory, Control and Data Acquisition system (SCADA) for the treatment plant
    - Control and indication at each location based on a Programmable Logic Controller (PLC)
    - Back-up power supplies for each PLC
    - All power and control cabling associated with the above plant shall comply with the relevant clauses of Volume 10 General Electrical Engineering Specification of these documents.

9.7.2 Treatment Works Operating Philosophy

The monitoring and control systems shall provide for the automatic operation for the process plant, pumping plant and their associated support and subsidiary plant installations, with minimum operator intervention.

9.7.3 Site Operation

1. The treatment plant shall be supervised by a SCADA system master station located in the administration building at the Wastewater Treatment Works.

2. Within each plant area, the individual plant installations shall be controlled by PLCs located within their respective local control panels. These PLCs shall communicate with the SCADA system master station. The local PLC system shall monitor the operation and carry out interactive control functions between the plant and installations within its sphere of operation. Any process safety or plant critical alarms/trips or controls shall be hardwired between plant installations. Each local PLC system shall incorporate a man machine interface (MMI) unit complete with a key pad for re-setting local parameters and set-points, a visual display unit for viewing plant status, parameters and set-points and an input terminal for the "Employer's Representative's" laptop computer.

3. Under abnormal operating conditions, or a control system failure, each plant installation shall be capable of being switched to manual control from local control panels and associated motor control and plant switchboards.

4. The local PLC systems shall pass all the plant information to the SCADA system master station. The SCADA system master station shall not directly control the plant, but shall have the ability to select modes of operation, i.e. duty rotation of pumps, when the plant is under automatic control of the local PLC system.

5. Automatic control sequences shall continue to operate under automatic control except when manually selected to "local", "off" or "plant" on the control panel.

6. PLCs shall be located in those areas where no control function is required. These shall only transfer data between the plant and the SCADA.

7. A SCADA master station shall operate autonomously with the ability to monitor the complete works in the event of the other master station being off-line or out of operation. On re-starting the off-line master station, it shall update its internal memories by retrieving the current data from the on-line (operational) master station.

8. All plant input/outputs shall be indicated at the local PLC system MMI unit. These signals shall subsequently be transmitted to the control rooms for processing, display and storage by the master station computer system.

9. A programme development system shall be provided which shall be capable of amending the system configuration and control database to incorporate future expansion to the works and also to take advantage of future technological developments which may take place in the field of wastewater treatment applications software.

10. Where a dedicated PLC control system is incorporated in a plant control panel then the PLC equipment shall utilise the same protocol/language as the SCADA system. However, if the Contractor proposes to use individual plant control systems with a different protocol/language than valid user certificates for the control panel to SCADA system protocol conversion shall be submitted to the Employer's Representative for consideration.

11. The facility to adjust the operational parameters on any item of plant shall be available at the PLC and remotely at each master station.

12. A PLC system shall comprise a PLC, front panel mounted keypad and display unit necessary for the control and monitoring of the plant for which that control panel is responsible. The direct control of plant from the motor control switchboards shall be manual only.

13. The PLCs shall scan all associated I/O for transmission to the master stations. Automatic control sequences for the plant shall be carried out within the local PLC control system; but under abnormal operating conditions, or a control system failure, the plant shall be

switched to manual control from the relevant local control panel(s) or motor control switchboard.

14. An inverter/battery UPS power system shall be installed in accordance with the General Electrical Specification to maintain each PLC system under a mains failure condition.

9.8 SCADA SYSTEM

9.8.1 General

A computer based SCADA system shall be provided to operate in conjunction with the PLC based control system by providing a man-machine interface at a central location within the works which can view and (to some extent) control the PLCs which run the works. The Contractor shall supply, install, test, and commission all necessary hardware, software and associated peripheral devices which will form part of the SCADA system.

Normal operation of the wastewater treatment system will be fully automatic and the SCADA equipment will be used to carry out functions such as mode control, set point adjustment, data logging and archiving at the same time as allowing one or more operators to monitor the system. The SCADA system functionality shall permit full access to all features, in any part of the site, from all operator workstations.

9.8.2 SCADA System Functions

The SCADA system shall carry out or assist the following actions:

- Indicate the status of all external doors leading from process/treatment areas
- Indicate status of all main or important drives;
- Indicate status of all actuated valves, bellmouths and actuators;
- Display the status of devices in graphical format (i.e. running, stopped, fault etc.);
- Display all analogue values measured by instruments;
- Annunciate alarms associated with the area of the plant concerned including details of the time the alarm occurred;
- Carry out totalisation of flows;
- Provide facilities for the operator to:
  - Acknowledge alarms;
  - View a journal of unacknowledged alarms;
  - View a journal of acknowledged and unacknowledged alarms;
  - Display and select the duty drive of duty/standby drive pairs;
  - Adjust and display process set points;
- Carry out real time and historic trending of analogue values;
- Carry out data archiving of all analogue values;
- Prepare daily, weekly, monthly and annual reports;
- Display a total hours run log of main or important drives.

9.8.3 SCADA System Hardware

The contractor shall provide the following hardware for the SCADA system:-

1. One operator's terminal (located at Cork County Council Offices – in Kinsale) complete with monitor, keyboard, mouse etc.
2. Two operator's terminals (located at the treatment works) each complete with monitor, keyboard, mouse etc. One of the computers shall be the "server" and the second computer shall be a "client"
3. One demonstration monitor to demonstrate the operation of the treatment plant for visitors. This shall be a 42 inch plasma type.
4. One USB interface laser jet type printer (A4 paper) for the treatment works.

5. One USB interface colour laser printer (A3 paper) for the treatment works.
6. Data back-up system comprising of 1 nr. CD-ROM writing unit (WROM).
7. One USB interface laser jet colour printer (A4 and A3 sheet size) for the Cork County Council Offices.

9.8.4 Furniture

The Contractor shall provide desks and furniture to house the computers, printers, UPS and associated peripherals and equipment. In addition the Contractor shall provide two operator's chairs.

9.8.5 SCADA System Software

The Contractor shall provide a proprietary software package or integrated packages for the SCADA system which has a proven track record in the European wastewater industry. Using this software the Contractor shall provide a fully programmed and configured system which shall include the following system functions:-

- Clear language menus for operator interface
- Password access for features on operator's panel
- Help facility for functions and alarms etc.
- Alarm annunciation and printing etc.
- Status monitoring of plant via volt free contacts
- Analogue signal monitoring of plant and instrument parameters
- User programmable software to allow operators to construct programmes for plant control
- Integrated control utilising proportional, integral and derivative control techniques
- Auto power up of plant after a power failure
- Logging of status of value of system points at regular time intervals or change of state and storing of this information / data
- Data analysis and report preparation utilising a proprietary spread sheet packages
- Permit monitoring of the SCADA system located at the Wastewater Treatment Plant, via the internet (World Wide Web) at the operator's terminal supplied for the Cork County Council Offices.

9.9 EFFLUENT QUALITY MONITORING

In order that the performance of the works may be effectively monitored, inlet and outlet wastewater and also sludge from various process areas are required to be analysed by on site instrumentation.

9.9.1 Instrumentation

1. Instruments shall be provided where necessary for measurement purposes, as required elsewhere in the Employer's Requirements, and for the proper operation and maintenance of the works.
2. Instruments shall be of an approved type from a major international manufacturer and be supplied with manufacturer's calibration certificate.
3. Instrument types include the following:-
   - Electromagnetic flowmeters
   - Ultrasonic level devices
   - Float switches and level sensors
   - Hydrostatic level measurement
   - Pressure measurement transducers

- Pressure gauges and switches
- Turbidity measurement
- pH measurement
- Composite samplers
- Analytical instruments
- Signal conditioners

9.10 TESTING AND COMMISSIONING

Equipment shall not be delivered to site unless an inspection has been carried out or waived in writing by the Employer's Representative. Tests should be organised to represent the installed condition as closely as possible and shall include the following:-

a) Factory Acceptance Tests (FATs)

These tests shall provide documented evidence that system under test meets the functional and performance requirements of the FDS (Functional Design Specification).

b) Site Acceptance Tests (SATs)

These tests shall encompass the normal modes of operation and failure modes and demonstrate correct functionality of the system in accordance with the Employer's Requirements. The tests shall be fully documented.

c) Commissioning

Commissioning shall be carried out on complete Design-Build Works where every item of equipment shall be individually tested and then collectively to form an integrated system.

10.0 TREATED EFFLUENT OUTFALL

10.1 GENERAL

10.1.1 Scope

The Treated Effluent Outfall shall comply in all respects with the Foreshore Licence issued by the Department of the Marine Communications and Natural Resources.

This section gives all the mandatory requirements relating to the design of the outfall at Commoge. Any offer that does not comply with this section in every respect is non compliant and will be treated as a qualified offer.

10.1.2 Capacity of Treated Effluent Outfall

The treated Effluent Outfall shall be designed for a capacity of 208 l/s.

10.1.3 Works Already Constructed – Contractor's Responsibility

A short section of the Treated Effluent Outfall has already been constructed and details are shown on Drawing 3505 1190. The contractor shall be responsible for connection to either end of this pipe and shall be responsible for the capacity of 208 l/s in the completed outfall pipe including the already constructed section.

10.1.4 Available Information

1. In addition to the published sources (Admiralty Tide Tables, Charts, DoE Offshore Design Code for Wind / Wave Data etc.), the following information is available:-

   a) Boreholes logs, cores, samples, testing and analyses carried out in 2003 on behalf of the Employer. The factual report of this investigation is contained in Volume 12.

   b) Geophysical survey carried out in 2000 on behalf of the Employer. The factual report on this investigation is contained in Volume 13.

2. Further information from other sources shall be researched by the Contractor.

3. The Contractor shall review all this information and may use it as a basis for this design.

4. The Employer does not warrant the accuracy or sufficiency of this data and errors in the information shall not relieve the Contractor of any of his responsibilities and duties under the Contract.

10.1.5 Design Responsibility

The Contractor shall be responsible for the design, construction, commissioning, operation and maintenance of the outfall. This responsibility shall include:-

a) Hydraulic design of the outfall and diffuser.

b) Compliance with the licences and consents, obtained by the Employer or with variations to these consents, as necessary for the Contractor's design or construction methods.

c) Selection and detailed specification of the materials, for every component of the outfall and diffuser.

d) Structural design of the outfall and diffuser covering both the temporary and permanent load cases for the permanent works.

e) The design of the temporary works including the side slopes of the dredged trench and the stresses in the permanent works during installation, to ensure that these do not impair the function or durability of the finished work.

f) Demonstrating that the outfall operates in the required manner.

10.2 MARINE LICENCES, PERMITS AND PERMISSIONS

10.2.1 General

The licences, permits, permissions and agreements outlined below have been obtained by the Employer and the Contractor shall comply with them or any variations or amendments to them that may be subsequently approved by the issuing authority. All other licences, permits, permissions and agreements shall be obtained by the Contractor.

10.2.2 Contractor Proposed Alternatives

1. If the Contractor wishes to propose a design, specification or method of construction which does not comply with the terms of one or more of the licences etc. or the premise on which they were obtained, the Contractor shall notify the Employer's Representative as soon as he becomes aware of this fact, clearly identifying the source of conflict.
2. The Employer's Representative shall consider the Contractor's proposals but shall be under no obligation to authorise any application to vary the terms of a licence etc. and may determine that the Contractor must comply with existing licence(s).
3. Where any licence, etc. can only be obtained in the name of the Employer, the Employer's Representative may give his consent to allow the Contractor to develop his proposals and apply for a revision or amendment to the relevant licence on behalf of the Employer. This shall be carried out at the Contractor's risk and the Employer will accept no responsibility for any consequences of pursuing an amendment, nor will he be obliged to assist the Contractor with his application.
4. Where the licence etc. can be obtained in the Contractor's name the Contractor may, with the consent of the Employer's Representative apply for a new or revised licence etc. The Contractor shall bear all risks for the consequences of his application.
5. The Employer's Representative may withdraw his consent if, in his opinion, the programme for completion of the works will suffer or if the Employer will be affected in any way to his detriment.
6. Nothing in the foregoing shall relieve the Contractor of his obligations under the contract.

10.2.3 The Foreshore Licence

1. The Foreshore Licence issued by the Department of the Marine Communications and Natural Resources covers the final effluent outfall at Commoge. The licence and the section of the application that applies to this outfall are included in Volume 13..
2. The Foreshore Licence covers all works below mean high water spring tide and permits the locating of the outfall, the construction of the temporary and permanent works and the discharge of effluent from the outfall.
3. With respect to this contract the licence does not specify an area for temporary stockpiling of excavated material. The Contractor shall apply to the Department of Marine Communications and Natural Resources for approval, under the licence, of his proposals.
4. The licence does not cover the dredging of suitable bedding, backfill or cover materials or the dumping at sea of surplus unsuitable material excavated from the outfall trench.

10.2.4 Mariculture Requirements

The Contractor shall comply with the requirements of the Department of the Marine Communications and Natural Resources.

10.2.5 Department of the Marine Communications and Natural Resources' Requirements

The Contractor shall comply with the following requirements of the Department of the Marine Communications and Natural Resources:-

a) The British Admiralty Hydrographer at Taunton, UK be informed of the final effluent outfall at Commoge upon completion.

b) A yellow special mark buoy with light is to be located in way of the diffuser at the end of the final effluent outfall pipe at Commoge.

c) The Commissioner of Irish Lights is to be consulted in relation to the sanctioning of new navigational aids/buoyage and/or alteration of existing navigational aids/buoyage.

d) The outfall pipe and diffusers at Commoge shall be laid, constructed and maintained in accordance with the Foreshore Licence Application drawings submitted and approved by the Minister.

e) The Contractor shall within 3 months of completion of works provide to the Minister full-scale drawings of the outfall pipe and diffuser as constructed.

f) The Contractor shall at all times keep the outfall pipe and diffuser at Commoge in a good and proper state of repair. .

g) The Contractor shall comply with the requirements of the Department's sampling programme.

h) The Contractor shall comply with the Department's requirement that any malfunction, stoppage or breakdown of the effluent treatment system at Commoge shall be notified immediately to the local Department of Marine Communications and Natural Resources Sea Fishery Office and Fish Quality Officers.

10.3 THE EMPLOYER'S DESIGN

10.3.1 Status of the Employer's Design

The Employer has carried out a conceptual design for the purpose of obtaining a Foreshore Licence; compliance with this design will not relieve the Contractor of any of his responsibilities or duties for design and compliance with the licences and consents.

Nevertheless the Contractor shall review the Employer's design and provide the conclusions of this review.

10.3.2 The Employer's Design Criteria

In addition to the mandatory requirements given above the Employer's design criteria include:-

a) Outfall internal diameter 560 mm.

b) Diffuser comprising 6 horizontal ports at 3 m centres.

c) The calculated discharge through the ports shall be equal at mean seal level (MSL) at maximum flow.

d) The design life of the outfall and diffuser shall be a minimum of 60 years.

10.4 DESIGN CRITERIA

10.4.1 Scope

In addition to compliance with the licences and consents as defined, the Contractor's design shall comply with the requirements set out in this section.

10.4.2 Design Codes, Reference and Text Books

1. Where a relevant design code or text book that is applicable exists (e.g. The Det Norske Veritas Rules for the Submarine Pipeline Systems, Department of the Environment –

Design of Offshore Structures etc.) it shall be used. Where no design code exists, the reference used shall be stated.

2. Copies of all design codes not referred to in this document and of all papers used shall be included in the first submittal in which they are used or attached as appendices to the calculation books.

3. The Contractor shall also include a list of the key text books (e.g. Roarkes Formulas for Stress and Strain, Lambe and Whitman Soil Mechanics, Tables for the Hydraulic Design of Pipes, Sewers and Channels – HR Wallingford & Barr) in this design submittal.

10.4.3 Overall Hydraulic Design

The outfall and diffuser shall be designed to discharge all the effluent from the works against a tidal level with a 1: 50 year return period.

10.4.4 Saline Intrusion and Purge

1. As far as physically possible the outfall and diffuser shall be designed to remain full of effluent at all times.

2. The fitting of “Tideflex” valves manufactured by the Red Valve Co. of Carnegie, Pa, USA (or approved equivalent), to all the ports will be deemed to satisfy this requirement.

3. If fitted, non return valves shall be designed to resist a back pressure equal to the maximum rise in sea level that could occur in any 12 hour period (i.e. around 3.6 metres).

4. If non return valves are not fitted, the outfall and the outfall and the diffuser shall be designed and operated so that:-

   a) The smallest peak daily flow (i.e. the minimum possible peak dry weather flow at commissioning) is sufficient to purge sea water from the outfall.

   b) The least densimetric Froude number at any port is not less than 1 (one) at the minimum night time dry weather flow, when the plant is commissioned.

   c) The flow, as defined at (a) above, shall be sufficient to remove settled sediment from the outfall and all parts of the manifold. It shall be assumed that this sediment may be derived from either the works or the sea or both.

10.4.5 Manifold

The manifold shall be designed so that the flow through any port, (in m^3 / sec) is between 0.9 and 1.1 * (max flow rate / total number of ports) when the sea is at MEAN SEA LEVEL [MSL] with a density of 1.025 and the flow through the works is a maximum.

The variables to be included in the calculation are: internal diameters of the main and branch pipes, port diameters, non return valve losses (at part flow), line to branch geometry (losses).

The manifold shall be tapered to ensure that all ports discharge at eh average dry weather flow rate.

10.4.6 Initial Dilution

The initial dilution shall be determined for the peak flow at mean high water springs MHWS, MLWS and MSL using any internationally accepted buoyant plume model.

The current CORMIX and RSB models of the US EPA are acceptable.

10.4.7 Security, Future Dredging and Accidental Load Cases

1. The Contractor shall adopt design parameters and materials to assure the integrity of the diffuser until 60 years after the issue of the Taking-Over Certificate.

2. Load cases to be considered and provided for in the design, shall include:-

- Direct hit by anchor dropped on the diffuser.
- Anchor cable dragged over the diffuser.
- Vessel straddling over the outfall / diffuser.
- Scour caused by wash from the propellers of vessels turning in the harbour over the outfall diffuser.
- Over dredging / dredging, either to form or maintain the specified pocket for the diffuser.

3. A risk assessment shall be carried out and the risk assessment and resulting design / indemnity / insurance policy, shall be presented with the design submittals.

10.4.8 Durability, Materials Design Life

Save for parts that can be replaced regularly as maintenance (e.g. “Tideflex” non return valves and impressed current cathodic protection systems) the components of the outfall shall be made from materials that should give a life of more than 60 years with the end of the useful life after 100 years.

10.4.9 Access for Cleaning

1. No provision for emptying the line is required.
2. The Contractor shall ensure that the capacity of the outfall and diffuser is not les than assumed in the design calculations for 20 years after commissioning. After 20 years he shall demonstrate that the k value is not greater than assumed in the design calculations.
3. Access points for cleaning shall be provided as the Contractor deems necessary, to enable him to comply with this obligation.

10.4.10 Load Cases

Load cases shall include all the identifiable temporary and permanent conditions and possible combinations of these conditions.

10.4.11 Material Standards

Material and Application	Life
Solid wall polyethylene in pipes exposed to effluent internally and buried externally or enclosed in steel or concrete.	Indefinite (compliant) if the normal in service stress is below the 500 year creep stress and it can be shown that there is no risk of fast fracture under any combination of combined applied and temperature stress.
Solid wall polyethylene in pipes exposed to flowing sea water (i.e. in the water column)	Nil, in the absence of evidence that there will be no attach by marine borers (not allowed).
Reinforced concrete in pipe surround, pipe linings and piles / support to the diffuser.	Compliant provided the crack widths are less than 0.2 mm (BS 8100) and all other criteria as required under the tables headed “intended for a working life of a least 100 years” in draft Standard prEN 206 “Concrete, Performance, Production and Conformity” or, if issued, the final version of this document.
Mortar Lining to steel pipes.	25 mm thick to AWWA C203 or 205 with 1:1 ratio sand : cementitious material by weight. Cementitious material 70% opc 30% pfa or equal.

Material and Application	Life
Other lining materials	Acceptable subject to corrosion allowance from the end of the proven coating life to 100 years.
Steel exposed to sea water / steel coated with a paint system + sacrificial anode cathodic protection.	Compliant with zero corrosion at 60 years in accord with DNV rules 1981 or 1996 or equivalent Standard.
Steel with no effective coating + impressed current cathodic protection.	Compliant with cathodic protection designed to DNV rules or other international Standard.
Tin bronzes (i.e. zinc free) & monel metal not in electrical contact with any steel part.	Compliant.
High performance plastics (e.g. nylon 66) for nozzles, bolts etc.	Compliant.
Stainless steel and other allow which resist corrosion by the formation of a stable oxide layer.	Generally not applicable.

Table 13: Material Standards

10.4.12 Stresses in Pipe Materials

1. Steel components shall not be stressed to more than the yield stress under any condition.
2. Steel tube shall not buckle if subjected to any identifiable load case. The DNV rules may be used to demonstrate compliance with this criterion.
3. Acceptable design philosophies and the related design assumptions are included below.

Pipe Type	Design Assumptions	Permitted Stresses
Steel tube wrap and non structural weight coat, plastic lining and corrosion allowance internally	All ring bending and longitudinal stress taken in the steel tube. Weight coat assumed to be cracked to the NA at all times.	In steel tube not more than:- 85% F_y during installation 66% F_y normal in service to 60 years 100% F_y normal in service after 100 years 100% F_y for accidental load cases with a probability of occurrence of less than 0.02 in any year.
As last but with mortar lining.	As last	As last, but normal in service not exceeding 180 N / mm^2
Steel tube with structural concrete surround and mortar lining	All ring bending taken in the concrete. Long stress taken in the steel tube.	As last but cracks in concrete calculated in accordance with BS 8110 less than 0.2 mm in service.

Table 14: Allowable Stresses in Pipe Materials

4. Plastic pipe shall be solid wall extruded polyethylene designation PE 100.
5. It shall comply with the requirements of the draft code EN 12201 Parts 1, 2 and 3 where these are applicable.

6. Design and installation shall be in accordance with the Water Research Centre "Polyethylene manual: 2nd edition 1994.

7. The combined stresses due to temperature, ring bending + internal pressure at low tide with a discharge of maximum flow shall be calculated. This stress shall not cause failure at 500 (five hundred) years based ion extrapolation of the manufacturer's test data from a test over not less than 1000 hours carried out with the specimen at 20 deg centigrade.

10.4.13 Joints

Joints that are equal in strength, stiffness and durability to the remainder of the lien and have been fully inspected before the pipeline enters the water are acceptable. Joints that satisfy this criterion include:-

a) Butt welds in steel tubes inspected by radiography with pipe wrap made good and holiday tested, concrete surround formed and either fully (14 day) cured or sealed in a temporary steel casing / formwork, lining made good and inspected to the same standard as the lining to the pipe sections.

b) Fusion welds in plastic pipe either:

- be made in the tube manufacturer's works or
- be made on land, at the site (i.e. not on the deck of a barge), be tested to assure complete fusion of 100% of the faces, by ultrasonic or other acceptable 100% non-destructive test

Joints made underwater shall:-

- Be as durable as the remainder of the line. Cathodic protection may be used to ensure that this criterion is satisfied.
- Have an axial (tensile) strength similar to the remainder of the line and in any case sufficient to resist all in service loads and stresses. Temperature stress shall be considered in this context.
- Be tested or installed so that their integrity can be demonstrated. For example by either de-watering the line after laying or pressure testing to show that the joints are drop tight.

10.4.14 Geotechnical, Dredging, Backfill & Armour

The Contractor shall:

a) Select side slopes for the dredged trenches and trenches across the foreshore that will be stable as long as necessary to lay the pipes and place the backfill.

b) Estimate the relative settlements that will occur along the outfall and diffuser, during construction, due to the normal in-service load cases and due to extreme / accidental load cases and demonstrate that the resulting stresses in the line are within the limits defined at 10.4.12 above.

c) In the littoral zone select backfill and armour that will be durable and stable for 100 years.

d) In the section between the littoral zone and the edge of the dredged slope place a surround to the pipe (granular fill and armour) that will assure stability, is consistent with b) above. Subject to the choice of pipe material the granular surround shall be marine sand and the coarse stone shall be graded 200 down stone.

10.4.15 Support for the Diffuser – Piling / Rock Mound

The diffuser may cause scour due to the combined effects of the local obstruction to the tidal flow, the jets from the diffuser ports and the buoyant flux from the discharge.

The Contractor shall design a support for the diffuser which will assure stability throughout the design life (refer to 10.4.8 above).

The contractor shall select the solution that he considers will minimise the cost throughout the design life and prepare his design accordingly.

10.4.16 Scour Prevention / Silting at the Diffuser

The Contractor shall design the diffuser and take other measures as necessary to ensure that it discharges in accordance with the specification, throughout the design life (refer to 10.4.8 above).

The possible effects of both scour and silting (up to the present bed level) shall be considered; if necessary provision shall be made to obviate the adverse effects of these limiting cases.

10.4.17 Permanent Marking and Lighting

The Contractor shall mark the diffuser with a buoy or fixed beacon. The mark shall be lighted. The day mark, light and the characteristics of the light shall be in accordance with the requirements of the Department of the Marine Communications and Natural Resources This mark shall be maintained by the Contractor for the duration of the concession.

If the Contractor opts to design and install the mark himself the design details shall be included in the submittals.

If he arranges for the mark to be provided, installed and maintained by the Commissioner of Irish Lights (or their contractor), he shall provide a copy of the agreement.

If a buoy is used it shall be laid (and lifted and re-laid when necessary) so that its moorings, ground chains and rising chain cannot come into contact with the diffuser.

Attachment D.1

TABLE D.1(i)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Primary Discharge Point)

Discharge Point Code: SW01 Kinsale

Source of Emission:	Primary Discharge
Location:	Worlds End Kinsale Harbour
Grid Ref. (12 digit, 6E, 6N):	E164238 N049703
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area _____ $m^3.sec^{-1}$ Dry Weather Flow _____ $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	600 m^3	Maximum/day	2500 m^3
Maximum rate/hour	104m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	Not availablem^3/sec		

TABLE D.1(i)(b):EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (Primary Discharge Point)

Discharge Point Code: SW01Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0-9.0	
2	Temperature	25°C	
3	Electrical Conductivity(@25°C)	1500	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	500	300
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	300	180
7	Chemical Oxygen Demand	600	360
8	Total Nitrogen (as N)	50	30
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P)	12	7.2
12	Orthophosphate (as P)[Note 1]	10	6.0
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) [Note 2] (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(i)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS
Primary Discharge Point - Characteristics of the emission

Discharge Point Code: SW01 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	**kg/day**	**kg/year**
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45µm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW01 Kinsale proposed

Source of Emission:	Primary Discharge Proposed
Location:	Commoge Kinsale harbour
Grid Ref. (12 digit, 6E, 6N):	E162615 n049527
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	3000m^3	Maximum/day	9000m^3
Maximum rate/hour	375m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	2.08m^3/sec		

TABLE D.1(i)(b):EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (Primary Discharge Point)

Discharge Point Code: SW01Kinsale proposed

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0 -8.5	
2	Temperature	30°C	
3	Electrical Conductivity(@25°C)	1000	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	30	270
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	20	180
7	Chemical Oxygen Demand	125	1125
8	Total Nitrogen (as N)	15	135
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P)	2.0	18
12	Orthophosphate (as P)[Note 1]	1.7	15.3
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) [Note 2] (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(i)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Primary Discharge Point - Characteristics of the emission

Discharge Point Code: SW01 Kinsale proposed

Number	Substance	As discharged		
		Max. daily average (μg/l)	**kg/day**	**kg/year**
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW02 Kinsale

Source of Emission:	Minor outfall
Location:	Summercove Kinsale/Kinsale Harbour
Grid Ref. (12 digit, 6E, 6N):	E165485 N049081
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	225 m^3	Maximum/day	Not available m^3
Maximum rate/hour	m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW02Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0 -9.0	
2	Temperature	<30 °C	
3	Electrical Conductivity (@25°C)	1500	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	500	112.5
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	300	67.5
7	Chemical Oxygen Demand	600	135
8	Total Nitrogen (as N)	50	11.25
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P) Note 1	12	2.7
12	Orthophosphate (as P)	10	2.25
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) Note 2 (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW02 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW03 kinsale

Source of Emission:	Minor Outfall
Location:	Scilly Kinsale
Grid Ref. (12 digit, 6E, 6N):	E164236 N050240
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal Area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	112.5 m^3	Maximum/day	Not available m^3
Maximum rate/hour	m^3	Period of emission (avg)	Intermittent min/hr _____hr/day day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point) (Secondary Discharge Point)

Discharge Point Code: SW03 Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0-9.0	
2	Temperature	<30 ^{o}C	
3	Electrical Conductivity (@25^{o}C)	1500	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	500	56.25
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	300	33.75
7	Chemical Oxygen Demand	600	67.5
8	Total Nitrogen (as N)	50	5.625
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P) Note 1	12	1.35
12	Orthophosphate (as P)	10	1.125
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) Note 2 (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW03Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW04Kinsale

Source of Emission:	Minor Outfall
Location:	Scilly ,Kinsale
Grid Ref. (12 digit, 6E, 6N):	E164468 N050350
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	112.5 m^3	Maximum/day	Not available m^3
Maximum rate/hour	m^3	Period of emission (avg)	Intermittent min/hr _____hr/day day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW04Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0-9.0	
2	Temperature	<30 °C	
3	Electrical Conductivity (@25°C)	1500	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	500	56.25
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	300	33.75
7	Chemical Oxygen Demand	600	67.5
8	Total Nitrogen (as N)	50	5.625
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P) Note 1	12	1.35
12	Orthophosphate (as P)	10	1.125
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) Note 2 (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS
Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW04 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	**kg/day**	**kg/year**
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW05 Kinsale

Source of Emission:	Minor Outfall
Location:	Pier Road Kinsale
Grid Ref. (12 digit, 6E, 6N):	E163979 N050357
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted No data available			
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	_____min/hr _____hr/day _____day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW05 Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	Not available	
2	Temperature	Not available	
3	Electrical Conductivity (@25°C)	Not available	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	Not available	Not available
5	Ammonia (as N)	Not available	Not available
6	Biochemical Oxygen Demand	Not available	Not available
7	Chemical Oxygen Demand	Not available	Not available
8	Total Nitrogen (as N)	Not available	Not available
9	Nitrite (as N)	Not available	Not available
10	Nitrate (as N)	Not available	Not available
11	Total Phosphorus (as P) Note 1	Not available	Not available
12	Orthophosphate (as P)	Not available	Not available
13	Sulphate (SO_4)	Not available	Not available
14	Phenols (sum) Note 2 (ug/l)	Not available	Not available

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW05 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not available	Not available	Not available
2	Dichloromethane	Not available	Not available	Not available
3	Simazine	Not available	Not available	Not available
4	Toluene	Not available	Not available	Not available
5	Tributyltin	Not available	Not available	Not available
6	Xylenes	Not available	Not available	Not available
7	Arsenic	Not available	Not available	Not available
8	Chromium	Not available	Not available	Not available
9	Copper	Not available	Not available	Not available
10	Cyanide	Not available	Not available	Not available
11	Fluoride	Not available	Not available	Not available
12	Lead	Not available	Not available	Not available
13	Nickel	Not available	Not available	Not available
14	Zinc	Not available	Not available	Not available
15	Boron	Not available	Not available	Not available
16	Cadmium	Not available	Not available	Not available
17	Mercury	Not available	Not available	Not available
18	Selenium	Not available	Not available	Not available
19	Barium	Not available	Not available	Not available

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW06 Kinsale

Source of Emission:	Minor Outfall
Location:	Pier Road ,Kinsale Harbour
Grid Ref. (12 digit, 6E, 6N):	E163985 N050374
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted No data available			
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	_____min/hr _____hr/day _____day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW06Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	Not available	
2	Temperature	Not available	
3	Electrical Conductivity (@25°C)	Not available	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	Not available	Not available
5	Ammonia (as N)	Not available	Not available
6	Biochemical Oxygen Demand	Not available	Not available
7	Chemical Oxygen Demand	Not available	Not available
8	Total Nitrogen (as N)	Not available	Not available
9	Nitrite (as N)	Not available	Not available
10	Nitrate (as N)	Not available	Not available
11	Total Phosphorus (as P) Note 1	Not available	Not available
12	Orthophosphate (as P)	Not available	Not available
13	Sulphate (SO_4)	Not available	Not available
14	Phenols (sum) Note 2 (ug/l)	Not available	Not available

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW06 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not available	Not available	Not available
2	Dichloromethane	Not available	Not available	Not available
3	Simazine	Not available	Not available	Not available
4	Toluene	Not available	Not available	Not available
5	Tributyltin	Not available	Not available	Not available
6	Xylenes	Not available	Not available	Not available
7	Arsenic	Not available	Not available	Not available
8	Chromium	Not available	Not available	Not available
9	Copper	Not available	Not available	Not available
10	Cyanide	Not available	Not available	Not available
11	Fluoride	Not available	Not available	Not available
12	Lead	Not available	Not available	Not available
13	Nickel	Not available	Not available	Not available
14	Zinc	Not available	Not available	Not available
15	Boron	Not available	Not available	Not available
16	Cadmium	Not available	Not available	Not available
17	Mercury	Not available	Not available	Not available
18	Selenium	Not available	Not available	Not available
19	Barium	Not available	Not available	Not available

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW07 Kinsale

Source of Emission:	Emergency overflow from Pumping Station
Location:	Pier Road ,Kinsale Harbour
Grid Ref. (12 digit, 6E, 6N):	E164168 N050069
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal Area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted no data available			
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	_____min/hr _____hr/day _____day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW07 Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	Not available	
2	Temperature	Not available	
3	Electrical Conductivity (@25°C)	Not available	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	Not available	Not available
5	Ammonia (as N)	Not available	Not available
6	Biochemical Oxygen Demand	Not available	Not available
7	Chemical Oxygen Demand	Not available	Not available
8	Total Nitrogen (as N)	Not available	Not available
9	Nitrite (as N)	Not available	Not available
10	Nitrate (as N)	Not available	Not available
11	Total Phosphorus (as P) Note 1	Not available	Not available
12	Orthophosphate (as P)	Not available	Not available
13	Sulphate (SO_4)	Not available	Not available
14	Phenols (sum) Note 2 (ug/l)	Not available	Not available

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW07 Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not available	Not available	Not available
2	Dichloromethane	Not available	Not available	Not available
3	Simazine	Not available	Not available	Not available
4	Toluene	Not available	Not available	Not available
5	Tributyltin	Not available	Not available	Not available
6	Xylenes	Not available	Not available	Not available
7	Arsenic	Not available	Not available	Not available
8	Chromium	Not available	Not available	Not available
9	Copper	Not available	Not available	Not available
10	Cyanide	Not available	Not available	Not available
11	Fluoride	Not available	Not available	Not available
12	Lead	Not available	Not available	Not available
13	Nickel	Not available	Not available	Not available
14	Zinc	Not available	Not available	Not available
15	Boron	Not available	Not available	Not available
16	Cadmium	Not available	Not available	Not available
17	Mercury	Not available	Not available	Not available
18	Selenium	Not available	Not available	Not available
19	Barium	Not available	Not available	Not available

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW08 Kinsale

Source of Emission:	Minor Outfall
Location:	Compass Hill,Kinsale
Grid Ref. (12 digit, 6E, 6N):	E163042 N049567
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal $m^3.sec^{-1}$ Dry Weather Flow Tidal $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	450m^3	Maximum/day	2500 m^3
Maximum rate/hour	104m^3	Period of emission (avg)	60 min/hr 24 hr/day 365 day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)

(Secondary Discharge Point)

Discharge Point Code: SW08 Kinsale

Number	Substance	As discharged	
		Max. daily average	
1	pH	6.0 -9.0	
2	Temperature	<30 °C	
3	Electrical Conductivity (@25°C)	1500	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	500	225
5	Ammonia (as N)	Not applicable	Not applicable
6	Biochemical Oxygen Demand	300	135
7	Chemical Oxygen Demand	600	270
8	Total Nitrogen (as N)	50	22.5
9	Nitrite (as N)	Not applicable	Not applicable
10	Nitrate (as N)	Not applicable	Not applicable
11	Total Phosphorus (as P) Note 1	12	5.4
12	Orthophosphate (as P)	10	4.5
13	Sulphate (SO_4)	Not applicable	Not applicable
14	Phenols (sum) Note 2 (ug/l)	Not applicable	Not applicable

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW08Kinsale

Number	Substance	As discharged		
		Max. daily average (µg/l)	kg/day	kg/year
1	Atrazine	Not applicable	Not applicable	Not applicable
2	Dichloromethane	Not applicable	Not applicable	Not applicable
3	Simazine	Not applicable	Not applicable	Not applicable
4	Toluene	Not applicable	Not applicable	Not applicable
5	Tributyltin	Not applicable	Not applicable	Not applicable
6	Xylenes	Not applicable	Not applicable	Not applicable
7	Arsenic	Not applicable	Not applicable	Not applicable
8	Chromium	Not applicable	Not applicable	Not applicable
9	Copper	Not applicable	Not applicable	Not applicable
10	Cyanide	Not applicable	Not applicable	Not applicable
11	Fluoride	Not applicable	Not applicable	Not applicable
12	Lead	Not applicable	Not applicable	Not applicable
13	Nickel	Not applicable	Not applicable	Not applicable
14	Zinc	Not applicable	Not applicable	Not applicable
15	Boron	Not applicable	Not applicable	Not applicable
16	Cadmium	Not applicable	Not applicable	Not applicable
17	Mercury	Not applicable	Not applicable	Not applicable
18	Selenium	Not applicable	Not applicable	Not applicable
19	Barium	Not applicable	Not applicable	Not applicable

TABLE D.1(ii)(a): EMISSIONS TO SURFACE/GROUND WATERS
Secondary Discharge Point) (1 table per discharge point)

Discharge Point Code: SW09 Kinsale PROPOSED

Source of Emission:	Emergency Overflow from proposed pumping station number 3
Location:	Scilly Walk, Kinsale
Grid Ref. (12 digit, 6E, 6N):	E165136 N050099
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	_____ $m^3.sec^{-1}$ Dry Weather Flow _____ $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted			
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	_____min/hr _____hr/day _____day/yr
Dry Weather Flow	m^3/sec		

TABLE D.1(ii)(b): EMISSIONS TO SURFACE/GROUND WATERS - Characteristics of the emission (1 table per discharge point)(Secondary Discharge Point)

Discharge Point Code: SW09 Kinsale PROPOSED

Number	Substance	As discharged	
		Max. daily average	
1	pH	***PROPOSED***	
2	Temperature	***PROPOSED***	
3	Electrical Conductivity (@25°C)	***PROPOSED***	
		Max. daily average (mg/l)	**kg/day**
4	Suspended Solids	***PROPOSED***	***PROPOSED***
5	Ammonia (as N)	***PROPOSED***	***PROPOSED***
6	Biochemical Oxygen Demand	***PROPOSED***	***PROPOSED***
7	Chemical Oxygen Demand	***PROPOSED***	***PROPOSED***
8	Total Nitrogen (as N)	***PROPOSED***	***PROPOSED***
9	Nitrite (as N)	***PROPOSED***	***PROPOSED***
10	Nitrate (as N)	***PROPOSED***	***PROPOSED***
11	Total Phosphorus (as P) Note 1	***PROPOSED***	***PROPOSED***
12	Orthophosphate (as P)	***PROPOSED***	***PROPOSED***
13	Sulphate (SO_4)	***PROPOSED***	***PROPOSED***
14	Phenols (sum) Note 2 (ug/l)	***PROPOSED***	***PROPOSED***

Note 1: For waste water samples this monitoring should be undertaken on a sample filtered on 0.45μm filter paper.
Note 2: USEPA Method 604, AWWA Standard Method 6240, or equivalent.

TABLE D.1(ii)(c): DANGEROUS SUBSTANCE EMISSIONS TO SURFACE/GROUND WATERS

Secondary Discharge Point - Characteristics of the emission (1 table per discharge point)

Discharge Point Code: SW09 Kinsale ***PROPOSED***

Number	Substance	As discharged		
		Max. daily average (µg/l)	**kg/day**	**kg/year**
1	Atrazine	***PROPOSED***	***PROPOSED***	***PROPOSED***
2	Dichloromethane	***PROPOSED***	***PROPOSED***	***PROPOSED***
3	Simazine	***PROPOSED***	***PROPOSED***	***PROPOSED***
4	Toluene	***PROPOSED***	***PROPOSED***	***PROPOSED***
5	Tributyltin	***PROPOSED***	***PROPOSED***	***PROPOSED***
6	Xylenes	***PROPOSED***	***PROPOSED***	***PROPOSED***
7	Arsenic	***PROPOSED***	***PROPOSED***	***PROPOSED***
8	Chromium	***PROPOSED***	***PROPOSED***	***PROPOSED***
9	Copper	***PROPOSED***	***PROPOSED***	***PROPOSED***
10	Cyanide	***PROPOSED***	***PROPOSED***	***PROPOSED***
11	Fluoride	***PROPOSED***	***PROPOSED***	***PROPOSED***
12	Lead	***PROPOSED***	***PROPOSED***	***PROPOSED***
13	Nickel	***PROPOSED***	***PROPOSED***	***PROPOSED***
14	Zinc	***PROPOSED***	***PROPOSED***	***PROPOSED***
15	Boron	***PROPOSED***	***PROPOSED***	***PROPOSED***
16	Cadmium	***PROPOSED***	***PROPOSED***	***PROPOSED***
17	Mercury	***PROPOSED***	***PROPOSED***	***PROPOSED***
18	Selenium	***PROPOSED***	***PROPOSED***	***PROPOSED***
19	Barium	***PROPOSED***	***PROPOSED***	***PROPOSED***

TABLE D.1(iii)(a): EMISSIONS TO SURFACE/GROUND WATERS
(Storm Water Overflow) (1 table per discharge point)

Discharge Point Code: SW08 proposed

Source of Emission:	Minor Outfall
Location:	Compass Hill,Kinsale
Grid Ref. (12 digit, 6E, 6N):	E163042 N049567
Name of receiving waters:	Kinsale Harbour
River Basin District:	South Western River Basin District
Designation of receiving waters:	Sensitive Waters
Flow rate in receiving waters:	Tidal area $m^3.sec^{-1}$ Dry Weather Flow $m^3.sec^{-1}$ 95%ile flow

Emission Details:

(i) Volume emitted	not available proposed location as part of Kinsale Sewerage Scheme		
Normal/day	m^3	Maximum/day	m^3
Maximum rate/hour	m^3	Period of emission (avg)	Min/hr hr/day day/yr

Attachment E.2

4.5 MONITORING SAMPLING AND ANALYSIS

4.5.1 General

1. The Contractor shall carry out monitoring, sampling and analysis of the wastewater and sludge as specified in Table 1: Sampling and Analysis below. Where sampling is required for compliance and payment purposes, the sample/s shall be 'split samples', half of which shall be analysed immediately by the Contractor. The Employer's Representative shall keep the other half in a suitable environment for random analysis.
2. Analysis that is capable of being carried out with the analytical equipment provided under the Contract shall be performed at the Plant by the resident operational staff. A recognised independent laboratory, as agreed with the Employer's Representative, shall carry out all other analysis.
3. Procedures and methods for the monitoring, sampling and analysis for the influent, effluent and sludge shall be provided as part of the Contractor's OMP.
4. The Contractor shall carry out monitoring, sampling and analysis in accordance with all relevant regulations in force in Ireland and in particular in accordance with S.I. No. 254 of 2001: Urban Waste Water Treatment Regulations, 2001, (hereinafter called '2001 Regulations') or any subsequent revisions.
5. The Contractor shall ensure that all on-site analysis is carried out in a safe manner and that all waste chemicals and containers are disposed of in a proper fashion.
6. Any additional analysis carried out by the Contractor that is not instructed by the Employer or the Employer's Representative, shall be at his own cost.
7. The Contractor shall set up an Information System for the display of a minimum of two years historical data. The system shall be capable of data handling and management reporting as agreed with the Employer's Representative.
8. Along with the general requirements, Table 1: Sampling and Analysis identifies the testing and monitoring frequency for those elements required in the preparation of reports to satisfy the Performance Management System.
9. All samples shall be composite 24 hour samples.
10. The Contractor shall ensure that any additional specific reporting procedures required by the PMS, shall be in all circumstances followed.

Parameter	Purpose	Location of Sampling Point	By	Frequency	Type
COD	Payment	Inlet to treatment process (D)	O&M Contractor	Daily	Signal
Raw Influent Flow	Payment	Inlet to treatment process (D)	O&M Contractor	Continuous	Signal
BOD_5	Monitoring	Inlet to treatment process (D)	O&M Contractor	Weekly	Composite 24 hour
Storm flow	Payment	Upstream of any bypass (B)	O&M Contractor	Continuous	Signal
Storm Overflow	Compliance	Overflow (C)	O&M Contractor	Continuous	Signal
BOD_5	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour
SS	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour

Parameter	Purpose	Location of Sampling Point	By	Frequency	Type
Phosphorus	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour
Ammonia	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour
COD	Compliance	Outlet from treatment process (E)	O&M Contractor	Daily	Signal
Nitrogen	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour
Faecal Coliform	Compliance	Outlet from treatment process (E)	O&M Contractor	Weekly	Composite 24 hour
Dewatered Sludge Solids	Compliance	Outlet from Sludge Treatment (J)	O&M Contractor	From each transport container	Spot samples
BOD_5	Compliance & Monitoring	Outlet from treatment process (E)	CCC or its agents	Random without prior notice	Composite 24 hour
SS	Compliance & Monitoring	Outlet from treatment process (E)	CCC or its agents	Random without prior notice	Composite 24 hour
Phosphorus	Compliance & Monitoring	Outlet from treatment process (E)	CCC or its agents	Random without prior notice	Composite 24 hour
Ammonia	Compliance & Monitoring	Outlet from treatment process (E)	CCC or its agents	Random without prior notice	Composite 24 hour

Table 1: Sampling and Analysis

4.5.2 Sampling Equipment

Automatic flow proportional samplers are required as set out in Employer's Requirements Part A Sub-Clause 5.17.2. The Contractor shall ensure that all samplers, including sample bottles and pipelines are regularly cleaned to avoid contamination and blockage.

4.5.3 Laboratory and Analytical Equipment

The Employer's Requirements with respect to the provision of a Laboratory and Analytical Equipment are included in Employer's Requirements Part A Clause 5.18.

The Contractor shall ensure that the laboratory and analytical equipment is kept in good working order and repair. Analytical equipment shall be calibrated on a regular basis and equipment shall be labelled to show details of the most recent calibration. Details of the frequency of and procedures for the calibration of analytical equipment shall be detailed in the OMP and reported as required by the PMS.

4.5.4 Analytical Methods

The analysis of samples shall be carried out in accordance with the "Standard Methods for the Examination of Water and Wastewater" produced by the American Public Health Association APHA), the American Water Works Association (AWWA) and the Water Environment Federation (WEF) (latest edition).

4.5.5 Independent Analysis

Independent analysis of all parameters required for compliance and payment purposes shall be carried out monthly, by an accredited independent laboratory approved by the Employer's Representative. A portion of the sample sent for independent analysis shall

be kept on site and tested as normal. The results shall then be compared and the attention of the Employer's Representative drawn to variances.

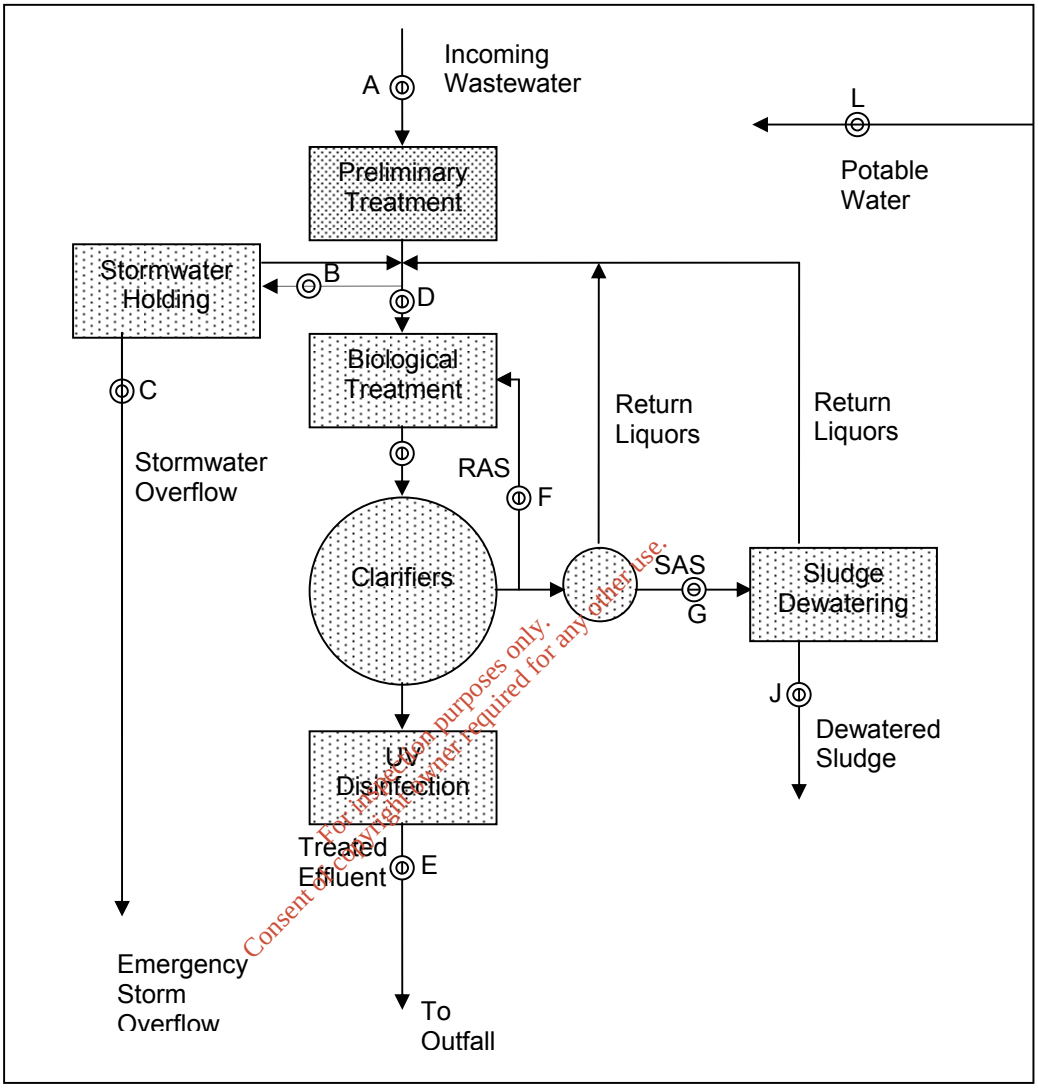


Figure 1: Location of Sampling Points

4.6 ANNUAL SAMPLING

4.6.1 Annual Sampling Requirements – Final Effluent

For compliance purposes with the 1994 and 2001 Urban Wastewater Treatment Directive Regulations, the contractor shall take a minimum of 52 samples of final effluent at a frequency of one sample per week. These samples will be analysed by an accredited independent laboratory approved by the Employer's Representative.

4.6.2 Annual Sampling Requirements – Sludge

Spot samples of dewatered sludge shall be taken from each skip (or other container) to be removed from the site for transportation to the designated disposal site. The samples taken shall be analysed by an accredited independent laboratory approved by the Employer's Representative.

Attachment E.4

Kinsale-Survey Data

Sampling Date	03/07/2008	30/07/2008		03/07/2008	08/07/2008		03/07/2008	30/07/2008		03/07/2008	30/07/2008		
Location Details	MH across from Town Pk			Culvert Discharge Point			Pumping Station			Summercove			
Location Number	Location1	Location1	Average Value	Location 2	Location 2	Average Value	Location 3	Location 3	Average Value	Location 4	Location 4	Average Value	
Sample	Outfall	Outfall	NA	Outfall	Outfall		Pumphouse	Pumphouse		Outfall	Outfall		
Flow M^3/Day	*	*	NA	*	*		*	*		*	*		
pH	7.9	7.2	7.55	7.4	7.1	7.25	7.5	6.9	7.2	8.1	8.2	8.15	
Temperature °C	*	*		*	*		*	*		*	*		
Cond 20°C	5.1	26600	13302.55	4150	2320	3235	2970	3250	3110	842	713	777.5	
SS mg/L	91	32	61.5	86	157	121.5	130	224	177	202	119	160.5	
NH_3 mg/L	23.3	4.1	13.7	12.1	9.6	10.85	20.9	27.7	24.3	50.5	26.9	38.7	
BOD mg/L	184	38.6	111.3	111	155.4	133.2	246	313.5	279.75	196	122.2	159.1	
COD mg/L	412	347	379.5	234	378	306	436	577	506.5	142	262	202	
TN mg/L	44		44	10		10	55		55	47		47	
Nitrite mg/L	*	0.58	0.58	*	2.66	2.66	*	<0.013	<0.013	*	0.676	0.676	
Nitrate mg/L	*	<1.78	<1.78	*	5.3	5.3	*	<1.78	<1.78	*	2.7	2.7	
TP mg/L	3.33	0.58	1.955	2.12	3.08	2.6	3.1	7.25	5.175	6.9	6.9	6.9	
O-PO4-P mg/L	3.81	0.97	2.39	2.4	1.63	2.015	3.14	4.8	3.97	6.9	6.9	6.9	
SO4 mg/L	231.7	1333.6	782.65	243.6	123.6	183.6	150.3	174	162.1	52	52	52	
Phenols µg/L	*	0.11	0.11	*	0.1	0.1	*	0.12	0.12	*	0.09	0.09	
Atrazine µg/L	*	<0.01	<0.01	*	<0.05	<0.05	*	<0.01	<0.01	*	<0.01	<0.01	
Dichloromethane µg/L	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	
Simazine µg/L	*	<0.01	<0.01	*	<0.05	<0.05	*	<0.01	<0.01	*	<0.03	<0.03	
Toluene µg/L	*	<0.1	<0.1	*	0.5	0.5	*	<0.1	<0.1	*	<0.1	<0.1	
Tributyltin µg/L	*	<0.05	<0.05	*	<0.05	<0.05	*	<0.05	<0.05	*	<0.05	<0.05	
Xylenes µg/L	*	<0.1	<0.1	*	0.5	0.5	*	<0.1	<0.1	*	<0.1	<0.1	
Arsenic µg/L	*	12.6	12.6	*	<2.0	<2.0	*	3.9	3.9	*	<2.0	<2.0	
Chromium mg/L	*	0.134	0.134	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	
Copper mg/L	*	<0.02	<0.02	*	0.0396	0.0396	*	0.0477	0.0477	*	0.0467	0.0467	
Cyanide µg/L	*	6	6	*	<5.0	<5.0	*	<5.0	<5.0	*	<5.0	<5.0	
Fluoride	*	0.54	0.54	*	340	340	*	420	420	*	0.38	0.38	
Lead mg/L	*	0.052	0.052	*	0.004	0.004	*	<0.003	<0.003	*	0.0044	0.0044	
Nickel mg/L	*	<0.02	<0.02	*	<0.005	<0.005	*	<0.005	<0.005	*	<0.005	<0.005	
Zinc mg/L	*	<0.02	<0.02	*	0.0529	0.0529	*	0.0226	0.0226	*	0.0481	0.0481	
Boron mg/L	*	1.651	1.651	*	0.27	0.27	*	0.23	0.23	*	<0.2	<0.2	
Cadmium mg/L	*	<0.02	<0.02	*	<0.001	<0.001	*	<0.001	<0.001	*	<0.001	<0.001	
Mercury µg/L	*	<0.2	<0.2	*	<0.2	<0.2	*	<0.2	<0.2	*	<0.2	<0.2	
Selenium µg/L	*	39.91	39.91	*	<1.0	<1.0	*	<2.0	<2.0	*	<2.0	<2.0	
Barium mg/L	*	0.023	0.023	*	0.0227	0.0227	*	0.0215	0.0215	*	0.0204	0.0204	

Location 1 Kinsale-Manhole across from town park on Pier Road
Location 2 Kinsale-Culvert Discharge Point under car park entrance
Location 3 Pumping Station
Location 4 Kinsale Summercove-manhole above Bullman Pub

Attachment G.1

Cork County

Water Services Investment Programme 2007 - 2009

Schemes at Construction	W/S	Est. Cost
Cork North		
Mitchelstown Sewerage Scheme (Nutrient Removal)	S	221,000
Cork South		
Ballyvourney/ Ballymakeery Sewerage Scheme	S	3,049,000
Cobh/ Midleton/ Carrigtwohill Water Supply Scheme	W	10,135,000
Cork Lower Harbour Sewerage Scheme (Crosshaven SS) (G)	S	4,850,000
Cork Water Strategy Study (G)	W	941,000
Kinsale Sewerage Scheme	S	20,000,000
Midleton Sewerage Scheme (Infiltration Reduction) (G)	S	2,078,000
		41,274,000
Schemes to start 2007		
Cork North		
North Cork Grouped DBO Wastewater Treatment Plant (Buttevant, Doneraile & Kilbrin)	S	5,150,000
Cork West		
Skibbereen Sewerage Scheme	S	20,000,000
		25,150,000
Schemes to start 2008		
Cork North		
Mallow/ Ballyviniter Regional Water Supply Scheme (H)	W	8,662,000
Mallow Sewerage Scheme (H)	S	5,408,000
Cork South		
Ballincollig Sewerage Scheme (Nutrient Removal) (G)	S	948,000
Ballingeary Sewerage Scheme	S	1,296,000
Bandon Sewerage Scheme Stage 2	S	14,729,000
City Environs (CASP) Strategic Study (G)	S	153,000
Cloghroe Sewerage Scheme (Upgrade)	S	683,000
Coachford Water Supply Scheme	W	1,318,000
Garrettstown Sewerage Scheme	S	2,153,000
Inniscarra Water Treatment Plant Extension Phase 1	W	2,678,000
Little Island Sewerage Scheme (G)	S	2,200,000
Cork West		
Bantry Sewerage Scheme	S	7,148,000
Dunmanway Sewerage Scheme	S	2,153,000
Leap/ Baltimore Water Supply Scheme	W	6,365,000
Schull Water Supply Scheme	W	5,253,000
		61,137,000
Schemes to start 2009		
Cork North		
Banteer/Dromahane Regional Water Supply Scheme	W	1,576,000
Conna Regional Water Supply Scheme Extension	W	2,627,000
Cork NE Water Supply Scheme	W	4,326,000
Cork NW Regional Water Supply Scheme	W	6,046,000
Millstreet Wastewater Treatment Plant (Upgrade)	S	1,628,000
Cork South		
Ballincollig Sewerage Scheme (Upgrade) (G)	S	22,248,000
Cork Lower Harbour Sewerage Scheme (excl. Crosshaven SS)	S	73,542,000
Shannagarry/ Garryvoe/ Ballycotton Sewerage Scheme	S	3,780,000
Youghal Sewerage Scheme	S	14,420,000
Cork West		
Ballydehob Sewerage Scheme	S	683,000
Bantry Water Supply Scheme	W	14,935,000
Clonakilty Sewerage Scheme (Plant Capacity Increase)	S	3,677,000
Courtmacsherry/ Timoleague Sewerage Scheme	S	2,472,000
Dunmanway Regional Water Supply Scheme Stage 1	W	12,669,000
		164,629,000
Serviced Land Initiative		
Cork North		
Ballyclough Water Supply Scheme	W	139,000
Ballyhooley Improvement Scheme	W/S	139,000
Broghill Rathgoggin Sewerage Scheme	S	406,000
Bweeng Water Supply Scheme	W	115,000
Churchtown Sewerage Scheme (incl. Water)	W/S	543,000
Clondulane Sewage Treatment Plant	S	417,000
Freemount Sewerage Scheme	S	150,000
Pike Road Sewerage Scheme (incl. Water)	W/S	2,080,000
Rathcormac Sewerage Scheme (incl. Water)	W/S	555,000
Spa Glen Sewerage Scheme	S	736,000
Uplands Fermoy Sewerage Scheme (incl. Water)	W/S	1,174,000
Watergrasshill Water Supply Scheme (incl. Sewerage) (G)	W/S	4,151,000
Cork South		
Ballincollig Sewerage Scheme (Barry's Rd Foul and Storm Drainage) (G)	S	1,164,000
Belgooley, Water Supply Scheme (incl. Sewerage)	W/S	2,913,000
Blarney Water Supply Scheme (Ext. to Station Rd) (G)	W	416,000
Carrigtwohill Sewerage Scheme (Treatment and Storm Drain) (G)	S	7,632,000
Castlematyr Wastewater Treatment Plant Extension	S	1,200,000
Crookstown Sewerage Scheme (incl. Water)	W/S	1,200,000
Dripsey Water Supply Scheme (incl. Sewerage)	W/S	1,112,000
Glounthane Sewerage Scheme (G)	S	1,576,000
Innishannon Sewerage Scheme	S	277,000
Innishannon Wastewater Treatment Plant	S	694,000
Kerrypike Sewerage Scheme	S	832,000
Kerrypike Water Supply Scheme	W	416,000
Killeagh Wastewater Treatment Plant Extension	S	1,200,000
Killeagh Water Supply Scheme (includes Sewerage)	W/S	485,000
Killeens Sewerage Scheme	S	420,000
Kilnagleary Sewerage Scheme	S	694,000
Midleton Wastewater Treatment Plant Extension	S	4,050,000