



An Independent Analytical Accredited Laboratory

6. Laboratory Reports

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VAT No. IE 6331864L, Registered in Ireland No. 311864
Directors: Mary Moynihan, William Phelan



Rev.No. 00

Confidential Report

Customer Contact: Mr. Ken Conroy
Customer Name: E.G. Petitts & Co.
Springville House
Blackrock Rd.
Cork

Date of Receipt: 16/06/01
Date of Analysis: 16/06/01
Date of Report : 26/06/01

Report Ref: A - 2878
Order No.: N / A

No. of Samples: 1
Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Saturday 16/06/01	10499	B.O.D.	4000 mg/L O ₂	SOP.P204
		Filtered B.O.D.	4160 mg/L O ₂	SOP.P204
		C.O.D.	6790 mg/L O ₂	SOP.P210
		Filtered C.O.D.	6460 mg/L O ₂	SOP.P210
		pH	5.2	SOP.P233
		Oils, Fats and Greases	4.455 mg/L	SOP.P256
		Suspended Solids	1184 mg/L	SOP.P202
		Settleable Suspended Solids	26 ml/L	SOP.P268
		Total Phosphorus	37 mg/L P	SOP.P207
		Nitrate	15 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	5 mg/L	SOP.P216
		Ammonia	1.1 mg/L NH ₃ -N	SOP.P236
		Chloride	274.9 mg/L	SOP.P205

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Saturday 16/06/01	10499	Sulphate	6.8 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	360 mg/L	SOP.P214
		Salinity	71.0 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.059 mg/L	SOP.P242
		Nickel	0.001 mg/L	SOP.P405
		Lead	0.02 mg/L	SOP.P253
		Zinc	1.650 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
Chromium	0.006 mg/L	SOP.P230		

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Approved By: 
Karen Murphy
Technical Manager.

Rev.No. 00

Confidential Report

Customer Contact:	Mr. Ken Conroy	Date of Receipt:	17/06/01
Customer Name:	E.G. Petitts & Co. Springville House Blackrock Rd. Cork	Date of Analysis:	18/06/01
		Date of Report :	26/06/01

Report Ref:	A - 2883	No. of Samples:	1
Order No.:	N / A	Sample Description:	Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Sunday 17/06/01	10507	B.O.D.	375 mg/L O ₂	SOP.P204
		Filtered B.O.D.	310.7 mg/L O ₂	SOP.P204
		C.O.D.	561 mg/L O ₂	SOP.P210
		Filtered C.O.D.	459 mg/L O ₂	SOP.P210
		pH	6.5	SOP.P233
		Oils, Fats and Greases	0.335 mg/L	SOP.P256
		Suspended Solids	484 mg/L	SOP.P202
		Settleable Suspended Solids	2 ml/L	SOP.P268
		Total Phosphorus	2.2 mg/L P	SOP.P207
		Nitrate	9.3 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	1.2 mg/L	SOP.P216
		Ammonia	2.3 mg/L NH ₃ -N	SOP.P236
		Chloride	429.86 mg/L	SOP.P205

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Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Sunday 17/06/01	10507	Sulphate	183.4 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	230 mg/L	SOP.P214
		Salinity	11.4 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.009 mg/L	SOP.P242
		Nickel	0.0002 mg/L	SOP.P405
		Lead	0.01 mg/L	SOP.P253
		Zinc	0.225 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
		Chromium	0.002 mg/L	SOP.P230

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 Springville House
 Blackrock Rd.
 Cork

Date of Receipt: 18/06/01
 Date of Analysis: 18/06/01
 Date of Report : 26/06/01

Report Ref: A - 2884
 Order No.: N / A

No. of Samples: 1
 Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Monday 18/06/01	10508	B.O.D.	367.85 mg/L O ₂	SOP.P204
		Filtered B.O.D.	407.1 mg/L O ₂	SOP.P204
		C.O.D.	563 mg/L O ₂	SOP.P210
		Filtered C.O.D.	580 mg/L O ₂	SOP.P210
		pH	6.8	SOP.P233
		Oils, Fats and Greases	0.412 mg/L	SOP.P256
		Suspended Solids	70 mg/L	SOP.P202
		Settleable Suspended Solids	0.2 ml/L	SOP.P268
		Total Phosphorus	8.6 mg/L P	SOP.P207
		Nitrate	6.8 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	0.88 mg/L	SOP.P216
		Ammonia	3.5 mg/L NH ₃ -N	SOP.P236
		Chloride	109.9 mg/L	SOP.P205

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Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Monday 18/06/01	10508	Sulphate	52.6 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	220 mg/L	SOP.P214
		Salinity	15.6 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.012 mg/L	SOP.P242
		Nickel	0.0005 mg/L	SOP.P405
		Lead	0.01 mg/L	SOP.P253
		Zinc	0.200 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
		Chromium	0.013 mg/L	SOP.P230

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Customer Contact: Mr. Ken Conroy
 Customer Name: E.G. Petitts & Co.
 Springville House
 Blackrock Rd.
 Cork

Date of Receipt: 19/06/01
 Date of Analysis: 19/06/01
 Date of Report : 26/06/01

Report Ref: A - 2887
 Order No.: N / A

No. of Samples: 1
 Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Tuesday 19/06/01	10514	B.O.D.	4035 mg/L O ₂	SOP.P204
		Filtered B.O.D.	3053 mg/L O ₂	SOP.P204
		C.O.D.	7090 mg/L O ₂	SOP.P210
		Filtered C.O.D.	5440 mg/L O ₂	SOP.P210
		pH	5.5	SOP.P233
		Oils, Fats and Greases	5.125 mg/L	SOP.P256
		Suspended Solids	1128 mg/L	SOP.P202
		Settleable Suspended Solids	20 ml/L	SOP.P268
		Total Phosphorus	48 mg/L P	SOP.P207
		Nitrate	28.25 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	6 mg/L	SOP.P216
		Ammonia	0.4 mg/L NH ₃ -N	SOP.P236
		Chloride	254.92 mg/L	SOP.P205

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Tuesday 19/06/01	10514	Sulphate	25.48 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	430 mg/L	SOP.P214
		Salinity	75.0 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.07 mg/L	SOP.P242
		Nickel	0.001 mg/L	SOP.P405
		Lead	0.02 mg/L	SOP.P253
		Zinc	1.625 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
	Chromium	0.006 mg/L	SOP.P230	

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Confidential Report

Customer Contact: Mr. Ken Conroy
 Customer Name: E.G. Petitts & Co.
 Springville House
 Blackrock Rd.
 Cork

Date of Receipt: 20/06/01
 Date of Analysis: 20/06/01
 Date of Report : 26/06/01

Report Ref: A - 2891
 Order No.: N / A

No. of Samples: 1
 Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Wednesday 20/06/01	10537	B.O.D.	4050 mg/L O ₂	SOP.P204
		Filtered B.O.D.	4240 mg/L O ₂	SOP.P204
		C.O.D.	6410 mg/L O ₂	SOP.P210
		Filtered C.O.D.	6470 mg/L O ₂	SOP.P210
		pH	5.2	SOP.P233
		Oils, Fats and Greases	3.455 mg/L	SOP.P256
		Suspended Solids	1804 mg/L	SOP.P202
		Settleable Suspended Solids	28 ml/L	SOP.P268
		Total Phosphorus	17.1 mg/L P	SOP.P207
		Nitrate	3.68 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	6.24 mg/L	SOP.P216
		Ammonia	2.9 mg/L NH ₃ -N	SOP.P236
		Chloride	190 mg/L	SOP.P205

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<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Wednesday 20/06/01	10537	Sulphate	41.04 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	390 mg/L	SOP.P214
		Salinity	77.0 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.05 mg/L	SOP.P242
		Nickel	0.003 mg/L	SOP.P405
		Lead	0.024 mg/L	SOP.P253
		Zinc	3.345 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
		Chromium	0.007 mg/L	SOP.P230

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Confidential Report

Customer Contact: Mr. Ken Conroy
 Customer Name: E.G. Petitts & Co.
 Springville House
 Blackrock Rd.
 Cork

Date of Receipt: 21/06/01
 Date of Analysis: 21/06/01
 Date of Report: 27/06/01

Report Ref: A - 2896
 Order No.: N / A

No. of Samples: 1
 Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Thursday 21/06/01	10564	B.O.D.	2910 mg/L O ₂	SOP.P204
		Filtered B.O.D.	3175 mg/L O ₂	SOP.P204
		C.O.D.	4760 mg/L O ₂	SOP.P210
		Filtered C.O.D.	4270 mg/L O ₂	SOP.P210
		pH	5.1	SOP.P233
		Oils, Fats and Greases	5.155 mg/L	SOP.P256
		Suspended Solids	1168 mg/L	SOP.P202
		Settleable Suspended Solids	30 ml/L	SOP.P268
		Total Phosphorus	40 mg/L P	SOP.P207
		Nitrate	0.49 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	4.58 mg/L	SOP.P216
		Ammonia	0.5 mg/L NH ₃ -N	SOP.P236
		Chloride	250 mg/L	SOP.P205

Certificate Of Analysis

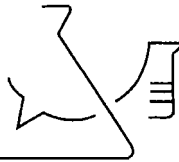
<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Thursday 21/06/01	10564	Sulphate	40.01 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	290 mg/L	SOP.P214
		Salinity	69.0 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.033 mg/L	SOP.P242
		Nickel	0.004 mg/L	SOP.P405
		Lead	0.015 mg/L	SOP.P253
		Zinc	2.890 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
	Chromium	0.005 mg/L	SOP.P230	

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Karen Murphy
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Confidential Report

Customer Contact: Mr. Ken Conroy
Customer Name: E.G. Petitts & Co.
Springville House
Blackrock Rd.
Cork

Date of Receipt: 22/06/01
Date of Analysis: 22/06/01
Date of Report : 27/06/01

Report Ref: A - 2901
Order No.: N / A

No. of Samples: 1
Sample Description: Effluent

Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Friday 22/06/01	10572	B.O.D.	4200 mg/L O ₂	SOP.P204
		Filtered B.O.D.	3030 mg/L O ₂	SOP.P204
		C.O.D.	5330 mg/L O ₂	SOP.P210
		Filtered C.O.D.	4850 mg/L O ₂	SOP.P210
		pH	5.3	SOP.P233
		Oils, Fats and Greases	5.000 mg/L	SOP.P256
		Suspended Solids	1128 mg/L	SOP.P202
		Settleable Suspended Solids	26 ml/L	SOP.P268
		Total Phosphorus	14.1 mg/L P	SOP.P207
		Nitrate	16.05 mg/L NO ₃ -N	SOP.P235
		Kjeldhal Nitrogen	6.25 mg/L	SOP.P216
		Ammonia	0.6 mg/L NH ₃ -N	SOP.P236
		Chloride	329.9 mg/L	SOP.P205

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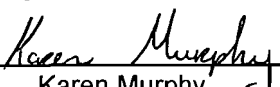
Certificate Of Analysis

<u>Sample Ref.</u>	<u>Lab No.</u>	<u>Test Description</u>	<u>Results / Units</u>	<u>Test Ref.</u>
Waterford Brewery Friday 22/06/01	10572	Sulphate	73.53 mg/L SO ₄ ²⁻	SOP.P243
		Alkalinity	416 mg/L	SOP.P214
		Salinity	71.3 mg/L	SOP.P422
		Cadmium	<0.002 mg/L	SOP.P252
		Copper	0.028 mg/L	SOP.P242
		Nickel	0.007 mg/L	SOP.P405
		Lead	0.015 mg/L	SOP.P253
		Zinc	3.145 mg/L	SOP.P257
		Mercury	<0.002 mg/L	SOP.P400
		Chromium	0.005 mg/L	SOP.P230

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Technical Manager.

3. Information Relating to Health & Safety Pre-Tender Safety & Health Plan

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PRE-TENDER SAFETY & HEALTH PLAN

This Pre-Tender Safety and Health Plan has been prepared in accordance with the Safety, Health & Welfare at Work (Construction) Regulations, SI No. 481 of 2001

1. GENERAL DESCRIPTION OF PROJECT

1.1 Client:

Waterford City Council, City Hall, Waterford.

1.2 Project Description:

This Contract provides for the following:

- Site clearance, earthworks, fencing and general site development work.
- Design, construction, commissioning, operation and maintenance of a wastewater treatment plant including process plant and associated civil and building works, associated pipework and of an outfall pipeline to the River Suir.
- Access road, site roads, landscaping
- Treatment and disposal of sludge arising from the plant.

1.3 Site Location:

The site is located at Gorteen in the area of Belview, County Kilkenny, approximately 4 km east of Waterford City. The Site is divided into three parts, the access road Site, the Wastewater Treatment Plant Site and the Outfall Site.

The Belview Port is some 1 km downstream of the Site, along the northern bank of the River Suir.

1.4 Drawings/Specification:

Refer to the Summary of Documents Page iii of this Volume for the full set of Tender documentation provided for this Contract, which include the drawings and the Specification (Employer's Requirements).

1.5 Site Restrictions:

The Site was formerly part of the land surrounding Springfield House. The house is now derelict but is not part of the site and as a listed building will be fenced to prevent access during the Contract.

The land on which the treatment plant will be located is currently livestock farm land and has no history of use other than agriculture.

The Site is bounded by agricultural land to the north, east and west and by the River Suir to the south. Residential property in the area consists of a few scattered properties to the east of the site access road and to the west of the treatment plant site.

A portion of the access road to the treatment plant site from the new link road from the public road (N29) will be constructed as part of this Contract.

A Foreshore Licence will be required to construct the treated effluent outfall.

An operational railway line that takes trains to and from the Port to the east of the site runs along and through the treatment plant and outfall sites. The treated effluent outfall pipeline crosses beneath the railway line and runs alongside it.

Work on treatment plant Site may be restricted by tidal conditions, work in the outfall site will be restricted by tidal conditions.

1.6 Relevant Adjoining Land Uses:

Private Road
Public Right of Way
Operational Railway Line
Agricultural land
Industrial land
River Suir.

2. INTENDED PROJECT COMPLETION TIME

2.1 Restrictions on Working Hours:

Normal working hours during construction

8 am - 8pm Monday – Friday, 8 am - 4pm Saturday

Working outside of normal working hours will be restricted by agreement with the Employer's Representative. Outfall construction hours may be 24 hrs. During Operation and maintenance the plant will operate on a 24 hour basis.

2.2 Restrictions on Access:

The access route to the Site will be restricted to the proposed new access road from the existing public road. The route of the access road is to be constructed as part of the Contract.

Only one temporary access across the railway line will be permitted.

Access to the outfall site below MHWT will be from the river by marine craft.

2.3 Other Contracts which may affect work (See Part 3 below):

Completion of the contract will be dependent on progress on the following contracts:-

- Contract 1 – Waterpark/Maypark/Gortens Civil Works

- Contract 4 – Belview Sewerage Scheme
- Link road from N29 and internal site roads for IDA lands at Belview entitled ‘Contract 1: Access Road’.

2.4 Anticipated Contract Commencement Date*: Dec. 2004.

2.5 Anticipated Contract Completion Date*: Dec. 2006

* Note: The anticipated commencement and completion dates advised above are provisional, pending confirmation by the Project Supervisor (Construction Stage) that they are practicable.

3. OTHER WORK ACTIVITIES

There are no known activities that are not included within the scope of the contract that interface with this Contract during the construction phase, except as below:

3.1 Contract Nr. 1 – Waterpark/Maypark/Gorteens Civil Works

This Contract is for the construction of the delivery mains from the city and environs and will carry most of the flow to the works. It will terminate just outside the site in a public right of way on the north west corner of the Site. The Contractor will connect into the main at the termination point. Until Contract Nr. 1 is complete the plant cannot be fully commissioned.

3.2 Contract Nr. 4 – Belview Sewerage Scheme

This is a small contract to construct a series of gravity mains delivering flow, from the local residences, along the east side of the access road to the gravity sewer to be constructed under Contract Nr. 5 along the access road. Contract Nr. 4 sewers will each terminate in a manhole on the access road and just outside the Site. In this Contract the connections will be made. Parts of the Contract Nr. 5 Works will not be able to be fully commissioned before Contract Nr. 4 is complete, but it will not affect the bulk of the commissioning.

3.3 IDA Lands at Belview, Co. Kilkenny Contract 1 : Access road

The link road from the N29 will be the only permitted access route for construction and operational traffic to the Site and so will have to be substantially complete before commencement of the WWTP site works. Service ducts and mains will be laid in the link road, into which the Contractor will have to connect similar facilities in the access road. The link road and the access road will both become the property of Kilkenny County Council and are planned to service the development by the IDA of an industrial park abutting the northern edge of the WWTP Site.

4. PARTICULAR RISKS

The following is the non exhaustive list of particular risks to the safety and health of persons as set out in Schedule 2 of S1 No. 481 of 2001. It is not intended that this document identify all safety and health issues pertaining to the Site. It will be the responsibility of the Project Supervisor for Design Stage and the Project Supervisor

for the Construction Stage to identify all safety and health issues and determine what elements of the work may fall within each risk category.

It should be noted that many of the risks on the project will arise out of working methods which are at the discretion of the Contractor and as such cannot be determined at this stage.

4.1 Work which puts persons at work at risk of burial under earthfalls, engulfment in swampland or falling from a height, where the risk is particularly aggravated by the nature of the work or processes used or by the environment at the place of work or site.

4.1.1 Burial Under Earthfalls, for example: deep foundations, deep cuttings, work near unstable ground or buildings:

Construction under this Contract will require excavations for pipe trenching and construction of tanks.

4.1.2 Engulfment in swampland, for example: unstable ground, work adjacent to lakes and ponds or reclaimed ground:

Construction of tanks, fencing, landscaping and other structures may involve the risk of flotation due to ground water. Construction of the outfall will involve construction in areas which are very soft and suitable only for specialist plant.

4.1.3 Falling from a height, for work, example: masts, towers, bridges, chimneys, steeples, over 2m where conventional scaffolding cannot be erected

The roof level for the superstructures and tanks may be > 2 m above ground level. Additionally deep tanks may be constructed below ground with potential openings in the cover slabs.

4.2 Work which puts persons at risk from chemical or biological substances constituting a particular danger to the safety and health of such persons or involving a legal requirements for health monitoring.

4.2.1 Work involved in connecting to, breaking into and diverting live sewers.

Work which may be required when pumping raw sewage.

4.2.2 Working with chemicals for odour extraction, flocculation, sludge conditioning.

Installation, commissioning and operation of dosing pumps, delivery systems, make-up and storage tanks.

4.3 Work with ionising radiation requiring the designation of controlled or supervised areas as defined in Article 20 of Directive 80/836/Euratom such as: radioactive lightning conductors, radioactive smoke detectors, other disused radioactive materials or plant, radioactive installations

Radiography of on-site welding will be required.

4.4 Work near high voltage power lines

- 4.4.1 External Existing overhead electric wires Location: Locations to be determined by on-site inspection.
- 4.4.2 External Existing underground electric wires Location: To be determined by on site trial pits/ inspection/consultation with utility companies.
- 4.4.3 Other Services
General Locations to be verified by on-site trial holes/inspections/ consultation with the utility companies/authorities.

4.5 Work exposing persons at work to the risk of drowning, for example: work significantly below water table, work to bridges, culverts, work on or near the sea, lakes, ponds, reservoirs:

Construction of underwater pipelines in tidal conditions, in a river.

Construction of tanks below groundwater level.

Construction of pipelines adjacent to intertidal zone.

4.6 Work on wells, underground earth work and tunnels, for example: excavated wells, underground earth works, tunnels, underpinning:

Pipejack/tunnel undercrossing of railway line. Possible construction of wells for water supply.

4.7 Work carried out by divers at work having a system of air supply:

Construction and inspection of underwater pipelines.

4.8 Work carried out in a caisson with a compressed air atmosphere:

None envisaged.

4.9 Work involving the use of explosives, for example: rock blasting or demolition:

None envisaged.

4.10 Work involving the assembly or dismantling of heavy prefabricated components for example: heavy steel structural frame elements, heavy precast concrete frame elements or heavy prefabricated plant items:

At the discretion of the Contractor and contingent on his choice of construction materials and method of working.

5. ADDITIONAL INFORMATION

The Project Supervisor for Design and the Project Supervisor for Construction are to be aware of the following:

Safe access to the Site shall be provided for personnel, plant and equipment.

Safe access shall be provided for emergency vehicles and the emergency services must be aware at all times of any access restrictions in place.

Safe Storage of materials to be provided.

Safe means of passage for pedestrian around and traffic in the vicinity of the site shall be provided by the Contractor.

Work will be required on/under/adjacent to an operating railway line. Liaison with the relevant authorities and agreement of working practices, method statements, safety personnel or other precautions will need to be undertaken early in the Contract. It can take six months to get information from Iarnród Éireann. Designs will have to be to the approval of the railway authority.

The information contained in this Preliminary Health and Safety Plan has been prepared prior to the commencement of the design or work on Site. It does not take account of any matters or information which may come to light after that time.

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4. Archaeologist's Reports

Report by Management for Underwater Archaeology, Feb. 2000
Report by Orla Scully "Monitoring of Engineer's Test Pits" March 2002.

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Archaeological Assessment
River Suir Pipeline Crossings
Waterford

(Covering collection system pipelines and
the WWTP outfall)

DC 7795

Commissioned by
E.G Pettit & Company,
Cork

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05 NOV 2002

Research: Claire Callaghan
Field Work: Eoghan Kieran
Report: Eoghan Kieran, Donal Boland
Date: Feb 2000

Management for Archaeology Underwater Ltd

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1. Introduction

1.1 Introduction

This report details the Archaeological Assessment of the River Suir at the townlands of Newtown and Bellview, County Kilkenny and Waterpark and Maypark/Ballynakill in County Waterford. The assessment was carried out on behalf of E.G. Pettit, Consulting Engineers, Cork in advance of pipelaying operations as part of Waterford Main Drainage Scheme.

The work was carried out according to the specifications of Dúchas, The Heritage Service, Department of Arts, Heritage, Gaeltacht and the Islands, and under licence, issued by the same authority in March 00.

The pre-development archaeological assessment of Forshore developments and Inland-waterway projects is required under Environmental Impact Legislation 85/337/EC and 97/11/EC. The protection of the archaeological heritage, is legislated for in The European Convention on the Protection of the Archaeological Heritage (revised) 1992.

1.2 Site Location

The river Suir divides the counties of Kilkenny from Waterford in the area of the proposed development. The townlands of Newtown and Bellview are located in county Kilkenny on the northern shore of the river. It is through these townlands that the Waterford to Rosslare railway passes. Maypark/Ballynakill and Waterpark, on the southern shores are contained within the borough boundary of Waterford City.

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2. The Development

2.1 The Development Proposal

- A river crossing of two 700mm mains pipes between Waterpark, Co. Waterford and Newtown, Co Kilkenny, on the river Suir.
- The utilisation of an existing 1800mm pipe at Waterpark, as a storm and emergency outflow
- A river crossing of two 350mm mains pipes between Maypark, Co Waterford and Newtown Co. Kilkenny, on the river Suir.
- The utilisation of an existing 500mm pipe at Maypark, as an emergency outflow.
- The installation of a waste outflow pipe, in the river Suir at Bellview, Co. Kilkenny

2.2 The Engineering Impact

The pipelines will be contained within a shallow trench, which will be excavated by way of a backhoe dredger mounted on a floating steel barge.

2.3 The Programme of Works

The Programme of Works has yet to be finalised.

3. Archaeological Assessment

3.1 Archaeological Requirements

In accordance with the specifications of Duchas, The Heritage Service, the following components were required to be contained within this archaeological assessment.

Desktop Survey

A comprehensive desktop survey of the area should be completed, prior to any visual inspection. This desktop survey should combine the background history of the area, with investigations of the archaeological finds from the area. This should be further supplemented by an inspection of both the archives of the land based 'Sites and Monuments Record' and the 'Maritime, Sites and Monuments Record'. The relevant Ordnance Survey maps from the earliest available series, 1841 should be checked for archaeological potential.

Intertidal Survey

The 1994 National Monuments act protects all archaeological material contained below the high water mark. As such all investigation, survey and excavation are licensed by Duchas, The Heritage Service and the National Museum of Ireland. The time of a spring tide was chosen as the optimum time to investigate the foreshore area to be impacted by the development. Low water afforded the best opportunity to view the maximum foreshore area.

Geophysical Survey

High-resolution marine geophysics is a non-intrusive, rapid method of surveying large tracts of the riverbed/seabed. This remote technique is non-destructive and therefore has no deleterious effect on the potential submerged or buried cultural resource. The techniques of marine magnetometry and side-scan sonography were employed in the geophysical survey of the river Suir.

3.2 Archaeological and Historical Background

Waterford City

There was some Viking settlement in Waterford during the ninth century but the first safe date for the establishment of a 'longphort' was 914AD. A longphort was established in order to facilitate further plundering of the surrounding areas, making Waterford a fortified harbour rather than an actual town or city at that time. By 1038 AD, the area had developed into what could be termed a town but its progression is patchy, with many references just referring to raids and attacks.

The primary Viking occupation appears to have been in the area around Reginald's Tower. This extended along the River Suir to the site of Turgesius Castle, south to St. Martin's Castle and returned along the marshy ground on the bank of John's River. This covered a triangular area of around 15 acres. Therefore the city was naturally protected on two sides by the Suir and John's River.

The landward side of the city, which was vulnerable to attack, was heavily fortified during the 11th and 12th centuries. 11th century defences were revealed during recent excavations and consisted of a deep ditch with a bank on the inner side, running parallel to Bakehouse Lane on the east side. The bank may originally have been over 3m high and may have also had a wooden palisade on top. Later the bank was partially demolished to allow the construction of a stone wall, which acted as a revetment against the remaining part of the bank. Excavations did not find any trace of defences on the southern side, where the marsh may have been sufficient. The town had a very regular street pattern, based on three E-W streets, High Street, Peter Street, and Lady Lane, with four N-S crossing streets, Henrietta Street, Keyser Street / Olaf Street / St. Francis Place, Exchange Street, and Arundel Square / Bakehouse Lane. The area between Reginald's Tower and the Cathedral was called Dundory, suggesting that this was the main area of settlement, with Henrietta Street probably forming the western limit of the tenth century town. During the 11th and 12th centuries the town expanded westwards in a series of stages until it almost reached Broad Street.

A Norse town continued until the Anglo-Norman invasion in the 12th century. Raymond Le Gros arrived first with a small contingent and after some brutal fighting took the town until Strongbow arrived four months later with reinforcements. Henry II followed Strongbow to Ireland and arrived in Waterford from Normandy in 1172 with a fleet of 240 vessels and around 500 knights and 4000 soldiers. By the 13th century the Anglo-Norman town extended further west along the line of Broad Street. There were fifteen gates and 23 mural towers along the town walls, the majority of which were located on the west and southwest sides. They were scarcer to the north where the Suir acted as a defence, and on the east and southeast where marshland and St. John's River acted as defence. St. John's Gate was probably one of the main gates of the town. The town continued to grow and develop during the 13th century, primarily due to it being a major seaport. In the Anglo-Norman period its proximity to English ports was very important and it was the landing place for all reigning English Kings that visited Ireland. 50% of the wine brought into Ireland was landed at Waterford and New Ross between 1276 and 1333. This was mainly due to John's charter of 1215, which stated that all vessels entering Waterford Harbour must off-load their cargo at Waterford.

Quay and Harbour Development

Waterford had an advantage over other ports due to its natural harbour and navigable rivers. It was Ireland's closest port to France and was also convenient to English ports, particularly Bristol which was a fine medieval port. The rivers of Nore, Suir and Barrow also connected Waterford with its prosperous hinterland of Wexford, Tipperary and Kilkenny. The importance of this riverine link between rural and urban communities is demonstrated by the large amount of late medieval tower houses along the Suir. All of these elements made Waterford the greatest importer of wine in the country and was the second largest importer of wool and hides by the end of the 13th century. The competition between Waterford and New Ross led to Lord Edward proclaiming that all merchants and masters of ship not from Leinster had to unload their cargo at Waterford.

The medieval quay of Waterford was located between Barronstrand Street and Henrietta Street on the site of Coal Quay, Custom House Quay and the Parade. Despite the town's importance as a port there is little information on the quays. In

1377 the king instructed the mayor and bailiffs of Waterford to repair and fortify the quay as the city had come under attack by the Spanish and other enemies, from the river.

By the fifteenth century Waterford was Ireland's leading port, merchants from which could operate free of toll in the important English port of Bristol. By 1570-1 over half the Irish ships landing at Bristol were from Waterford. Fish formed a large part of goods exported from Waterford. In 1592-3 85% of the herring landed at Chester originated from Wexford, Waterford and New Ross. In 1698 it is noted that the amount of herring being exported from Wexford and Waterford to the south of England was so great that the ports around Dover were almost ruined. The largest traditional estuarine fishery survives on the River Suir. At the turn of the century there were about 1,000 cots fishing in the area, using snap-net technique, a method which is still carried out by over 200 Suir cots. These are distinctly different from other river cots and could possibly have dugout origins.

Lewis states that the quay was enlarged in 1705 and stretched for one mile. In 1745 Smith said the quay was over half a mile long, paved and faced with cut stone. It was up to forty feet wide in parts and was considered of be of a quality superior to any in Europe. There was sufficient water for the largest trading vessels to come alongside and could moor just off it at all times. The Exchange, Custom house and other public buildings were built along it and five piers attached to the quay allowed ships of 500 tons to come alongside with safety. In front of the quay, the road had 4 to 5 fathoms of water at low tide and there was enough room for up to 60 sailing ships to lie. The water changed by three fathoms with the tide. There was an area at the West End that was used for caulking and 'graving' vessels, which was known as Graving Bank. A little below to the east was a dry dock, which was 160 feet long, 48 feet broad and 15 feet deep, and was properly equipped with floodgates. Pipes and conduits were also placed along the quay to facilitate vessels to take on water.

By the middle of the 14th century the import trade had declined drastically but the period 1766-1771 saw a growth in overseas trade. Salt beef, salt pork and butter were the main commodities of Waterford, a trade that increased by a third in the 1770's. Young reported that in 1777 the number of vessels belonging to the port had increased

from less than 30 to 80 since 1757. The quay at Waterford was also said to be better than any he had previously seen. A dry dock was built in the east end of Waterford by Ambrose Congreve, an example of local landlords investing in shipping.

The city of Waterford was connected to Ferrybank, on the other side of the Suir, by a wooden bridge. This was supported on stone abutments and 40 sets of oak piers and measured 832 feet in length and 40 feet in breadth. Construction of the bridge commenced in 1793 and was carried out by Mr. Cox of Boston.

In the early 19th century a tidal mudflat known as 'The Ford', located north of the island that lay to the east of the city, was removed. The mudflat had forced ships to take the southern channel, which had a rock mid stream, thereby only allowing sailing ships to reach the city at certain states of wind and tides. Work, which commenced in 1817, also involved the construction of new quays to the bridge and the deepening of the water beside the existing quays. The new channel was widened by 60 feet to 210 feet with a minimum low water depth of 7 feet. The developments also included the provision of ballast for vessels and the regulation of pilots. These improvements cost a total of £21,901, £14,588 of which was paid by the Government and the rest was received from duties levied on shipping in the area. Lewis states that up until 1820 the port of Waterford was considered to be very poor in its provision for repairing ships. By the 1830's a dockyard had been constructed across from Waterford, on the north side of the Suir.

In the years 1818 to 1850 there are records outlining the problems for packets due to wreck in the harbour and also comment on the presence of illegal stake weirs in the harbour. In 1846 it is stated that despite the attempts to clear a channel up to Waterford, there was still an extensive mudbank at the quays of the harbour. This was thought to be caused by the dumping of dredged material in another part of the same river and by the thousands of tons of waste stones dumped into the river from Granagh quarry.

In 1878 Marmion wrote that Waterford harbour was well situated for commerce due to its proximity to the West Coast of England. Despite the fact that it was eighteen miles from the sea, the largest merchantmen could come up opposite the quays, which

he considered to be the finest in Ireland and possibly England, being 1,240 yards long and forty feet wide.

Boats and Waterford Harbour

In Medieval times Norman long boats, cogs and hulks would have been some of the boat types commonly in use. Some of the traditional boats in use in Ireland today were also in use during medieval times, such as the currachs, coracles, river cots, and some of the clinker boats. There are records for hulks being used all over Northern Europe, including the Waterford area, for the transport of bulk cargo. No wreck has ever been found but the iconography for hulks show large curving timbers and it has been speculated that they could have been reverse clinker planking. The cog, a flat-bottomed decked vessel, became the great cargo ship of the Hansiatic league. The boats appear on seals of Dublin and other major cities, while the literature shows that many cogs were owned by Irish merchants on the river Suir. Barges were used in large numbers and one particular type of shallow draft barge was designed to negotiate the shallows up to Clonmel. In 1878 120 barges were employed in the river trade.

3.3 The Sites and Monuments Record

The National Monuments Sites and Monuments Record have Three sites listed for the townlands of Newtown and neighbouring Christendom, in County Kilkenny. All three are Fulacht fiadh. The townland of Bellview, in county Kilkenny, has a castle listed but it is some distance from the proposed development site. There are no listed sites for both Waterpark and Maypark/Ballynakill in County Waterford.

Site Number	Classification
KK 046:13	Fulacht fiadh
KK 046:14	Fulacht fiadh
KK 046:15	Fulacht fiadh
KK 047:01	Castle

3.4 The National Museum Files

The National Museum files have no recorded finds of archaeological importance for the vicinity of the proposed development at Maypark/Ballynakill and Waterpark in County Waterford and Newtown and Bellview in County Kilkenny.

3.5 The Maritime Wreck Inventory

There are a large number of wrecks recorded for Waterford Harbour and Waterford River but as locational information is vague, it is impossible to say how close to the city of Waterford they were lost. An unknown vessel was lost off Dundory, Waterford Harbour, in July or August of 1497. This vessel, which was one of eleven vessels under the Earl of Desmond, was sunk as they tried to besiege the city of Waterford. A breech loading cannon with reinforcing rings, typical of the period, was dredged from the Suir by the Harbour Commissioners in 1901. Ship timbers were also recovered but were destroyed.

3.6 Intertidal Investigations

No features of archaeological importance or potential were noted during the intertidal investigations.

At Waterpark an existing pumping station has an outflow pipe opening into the river. The foreshore appears to have been reclaimed at the time of the station's construction (See Plate1). A river retaining wall delineates the reclaimed area from the river. Estuarine silts and debris have built up against this wall and obscure much of it from view. The construction of the existing pumping station and the associated outflow pipe may have removed archaeology as nothing of archaeological significance was noted in the area.

The foreshore at Newtown, similar to Waterpark, appears to be reclaimed. This reclamation was undertaken to facilitate the construction of the Waterford to Rosslare railway (See Plate 2). Close to this area, more evidence of this reclamation can be seen as, a large supporting wall, has been built to support the railway. An older and more natural foreshore can be seen on the landward side of the railway tracks.

The foreshore at Maypark/Ballynakill also has been subject to development. The dumping of waste building material on the riverbank has extended it into the river (See Plate 3). Similar to Waterpark there is an already existing pumping station at the site. It too has an outflow pipe opening into the river. Rubble and estuarine silts can be seen on the foreshore here but nothing of archaeological interest was noted.

Newtown, on the opposite bank of the river to Maypark/Ballynakill, has a very obvious reclaimed shoreline. A large concrete wall was built on the foreshore (See Plate 4). Which supports the Waterford to Rosslare railway. A small outflow pipe empties from the base of this structure onto the steep gravel foreshore. As with the other foreshore area in Newtown, the original foreshore can be seen on the landward side of the railway.

The Foreshore at Bellview, the location of the outflow pipe, is muddy and silty. A stone built retaining wall travels the length of the foreshore. It separates the foreshore from an artificially reclaimed area (See Plate 5). The ground level on this reclaimed area, inside this retaining wall is 1m above that of the foreshore. Gravels and clay were filled onto the original shore level to reclaim this area. This again was undertaken as part of the development of the Waterford to Rosslare railway.

3.6 Geophysical Survey

The geophysical survey was conducted on the 15th/16th Jan .00 utilising an *EdgeTech* Model DF 1000 dual-frequency digital towfish in association with an Isis system with a Triton data collection system and a *Geometrics G-881* caesium vapour magnetometer.

Navigation (lath long), with an accuracy of +/- 1m, was provided by a *Raython* differential global positioning system.

Throughout the survey, the side-scan sonar system was operated at a swath width of 100m and an operating frequency of 100 and 500 kHz, ensuring complete coverage of the proposed sites.

In general, the riverbed is characterised by muddy and sandy sediment. Anomalies are readily apparent, as their geophysical signature is very different from that of the estuarine sediments.

One anomaly was identified in the vicinity of the proposed development area at Waterpark. Investigations identified the contact as a navigational hazard marker buoy, marking the location of an 1800mm outfall pipe (See Plate 6).

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4. Results of the Assessment

4.1 Conclusion

No archaeological features were noted in or close to the areas to be impacted by the proposed pipelines

The Northern bank of the river from Waterford City to Belview Port has been extensively reclaimed to facilitate the construction of the Waterford to Rosslare railway.

The proposed development sites of on the southern bank of the river have been impacted previously and as such there is little potential of impacting archaeology.

There are no listed archaeological sites or recorded finds for the proposed areas, as such the areas would appear to be devoid of archaeology.

Geophysical survey located one feature in the proposed development areas, which was noted as the anchoring system for a navigational hazard marker buoy.

4.2 Recommendations

It is recommended that the project is to proceed as planned.

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5. Figures and Plates

5.1 Figures

Fig .1	Area Location Map
Fig. 2	Site Location Map
Fig. 3	Geophysical Scan Chart Waterpark Crossing
Fig. 4	Geophysical Scan Chart Maypark Crossing
Fig.5	Geophysical Scan Chart Belview Outfall
Fig.6	Location Map Waterpark Crossing
Fig.7	Location Map Maypark Crossing
Fig.8	Location Map Belview Outfall

5.2 Plates

Plate 1	Waterpark from N
Plate 2	Newtown from S
Plate 3	Maypark/Ballynakill from N
Plate 4	Newtown from S
Plate 5	Bellview from S
Plate 6	Navigation Marker from N

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Fig 1 Area Location Map

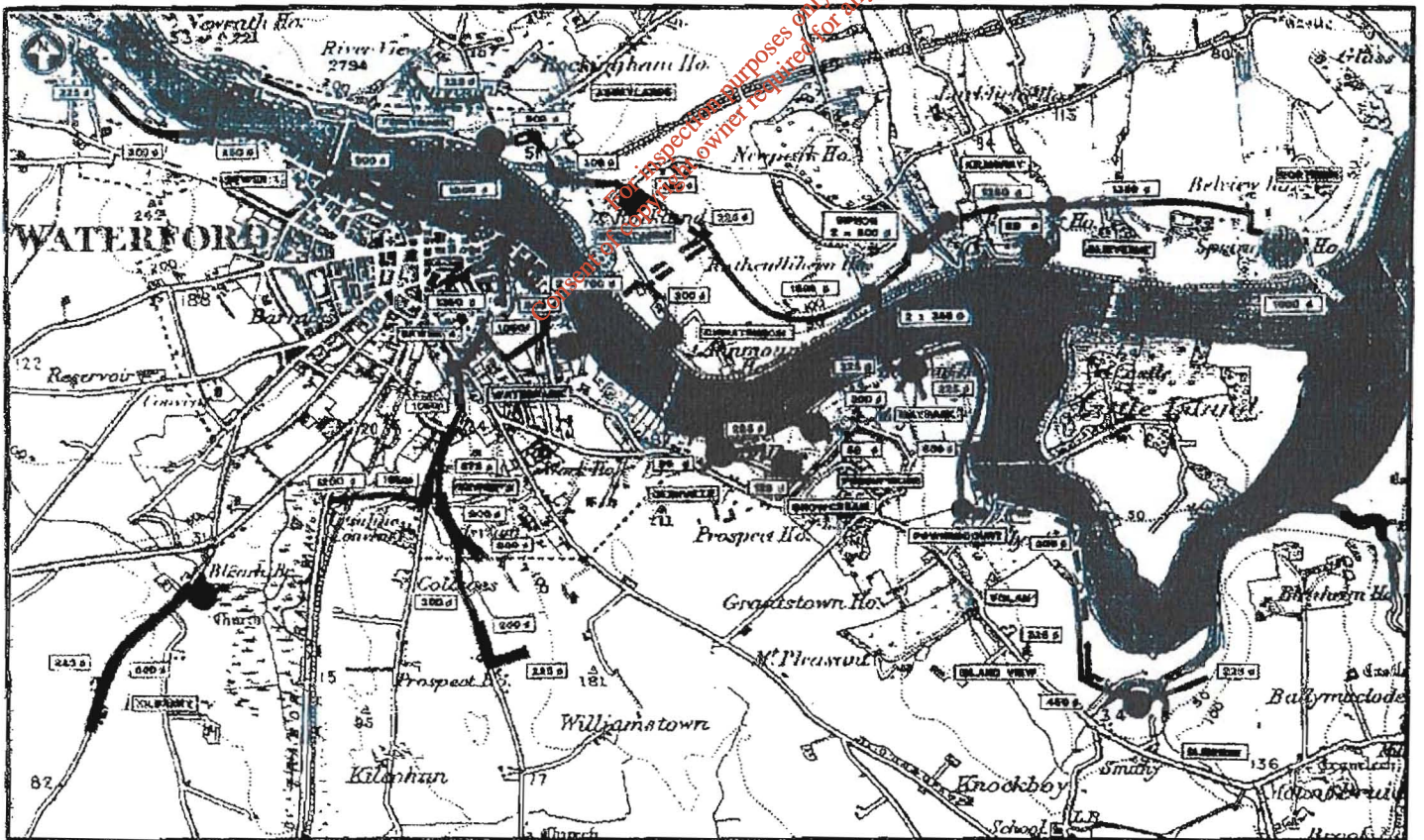
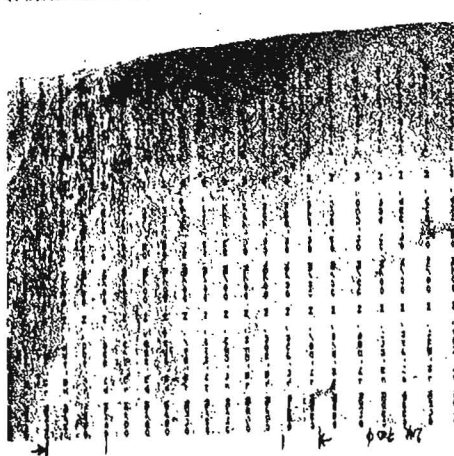
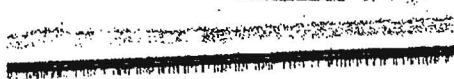
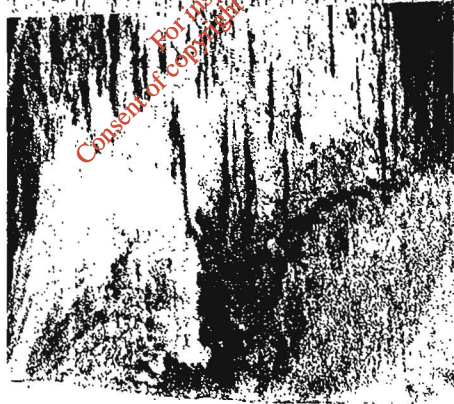
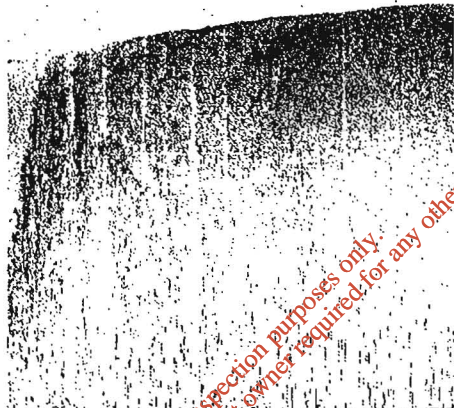


Fig 2 Site Location Map



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Fig 3 Scan Chart Waterpark Crossing

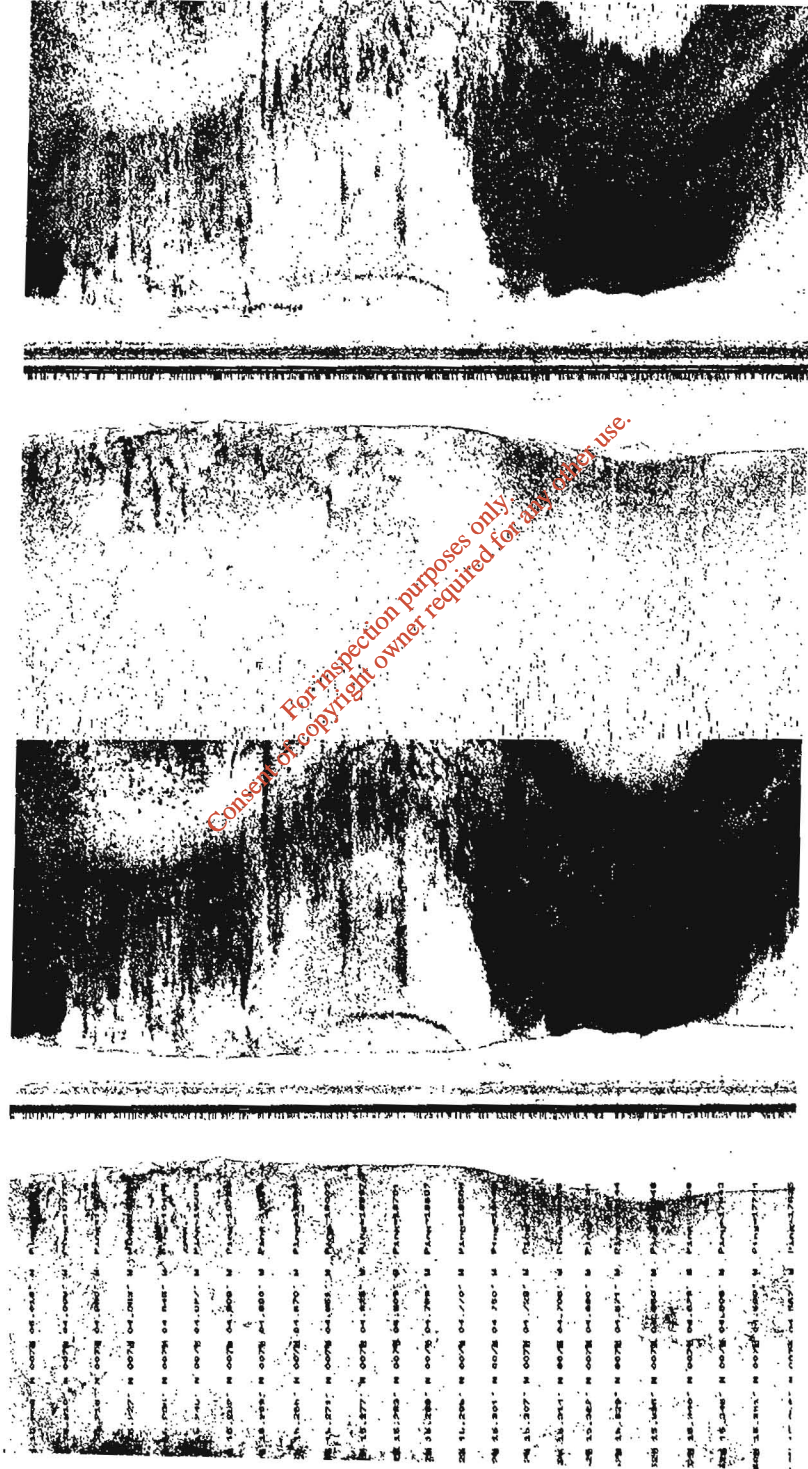


Fig 4 Scan Chart Maypark Crossing

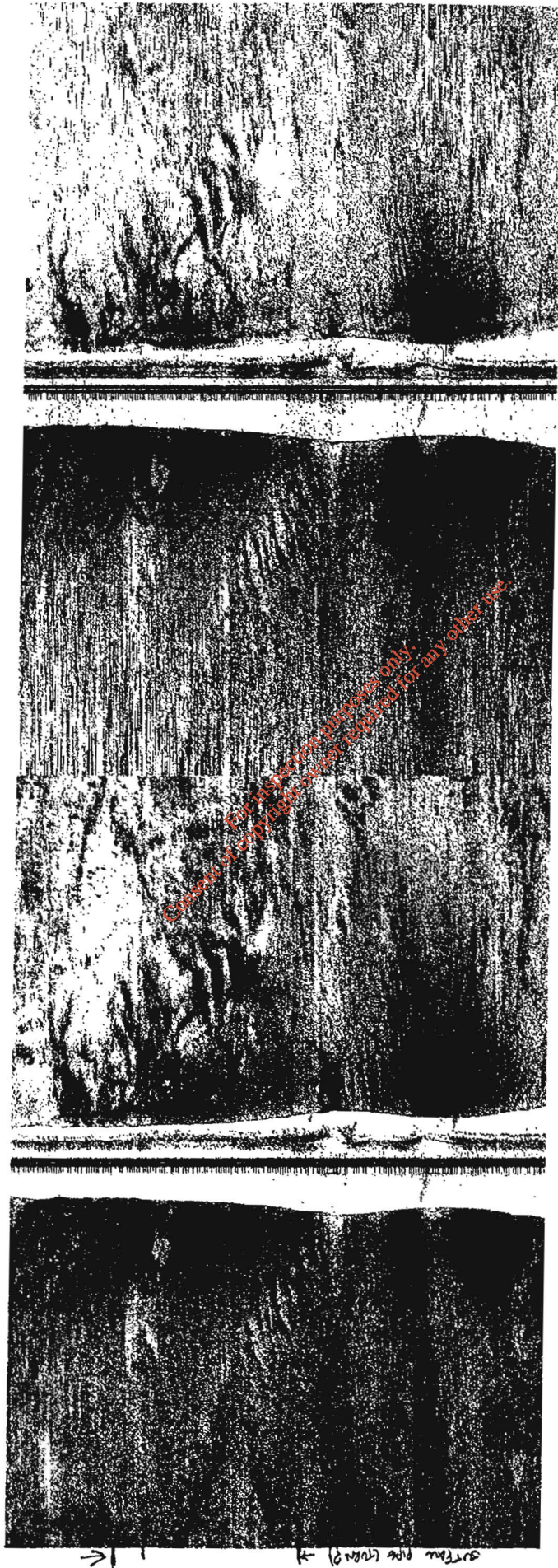
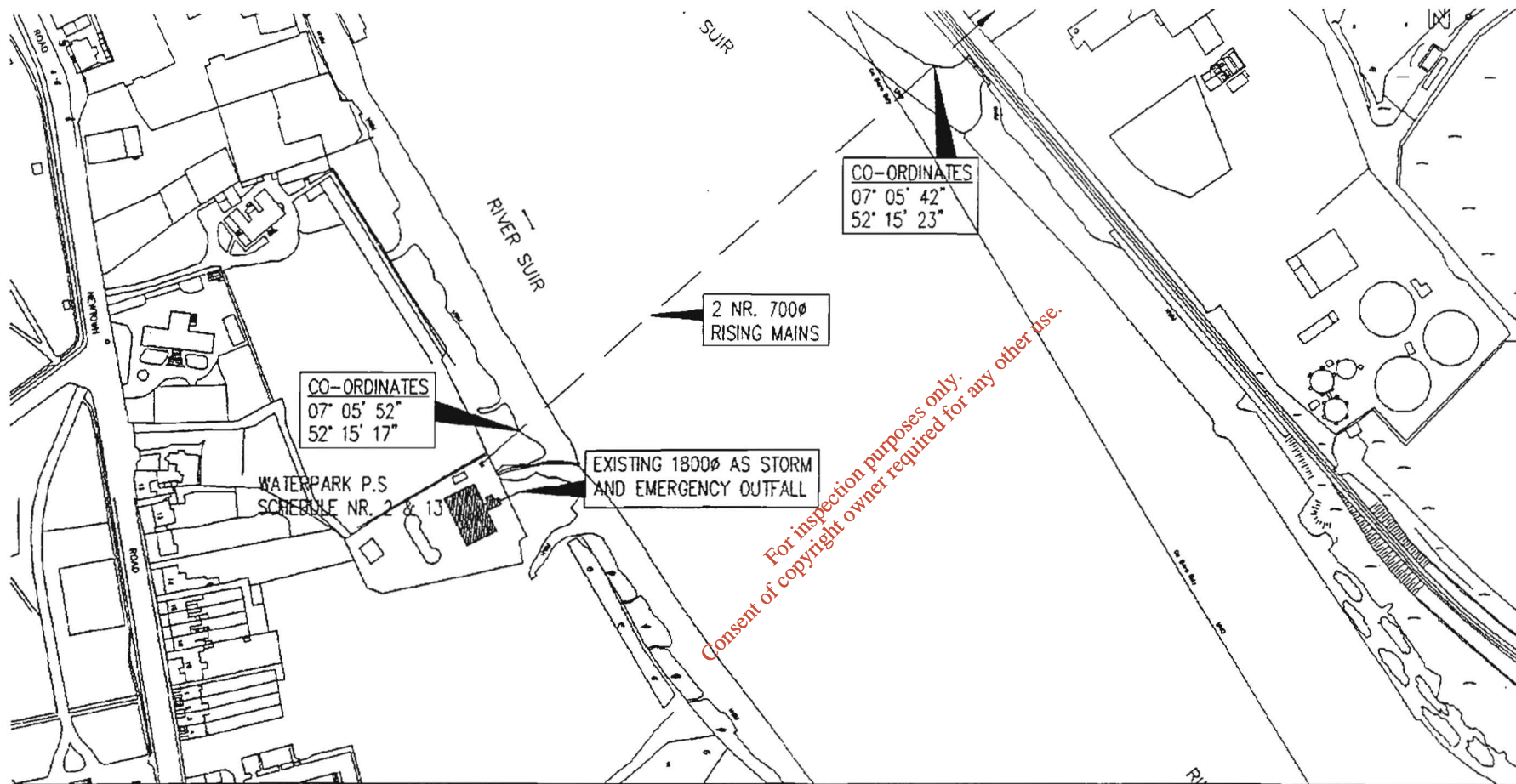


Fig 5 Scan Chart Bellview Outfall

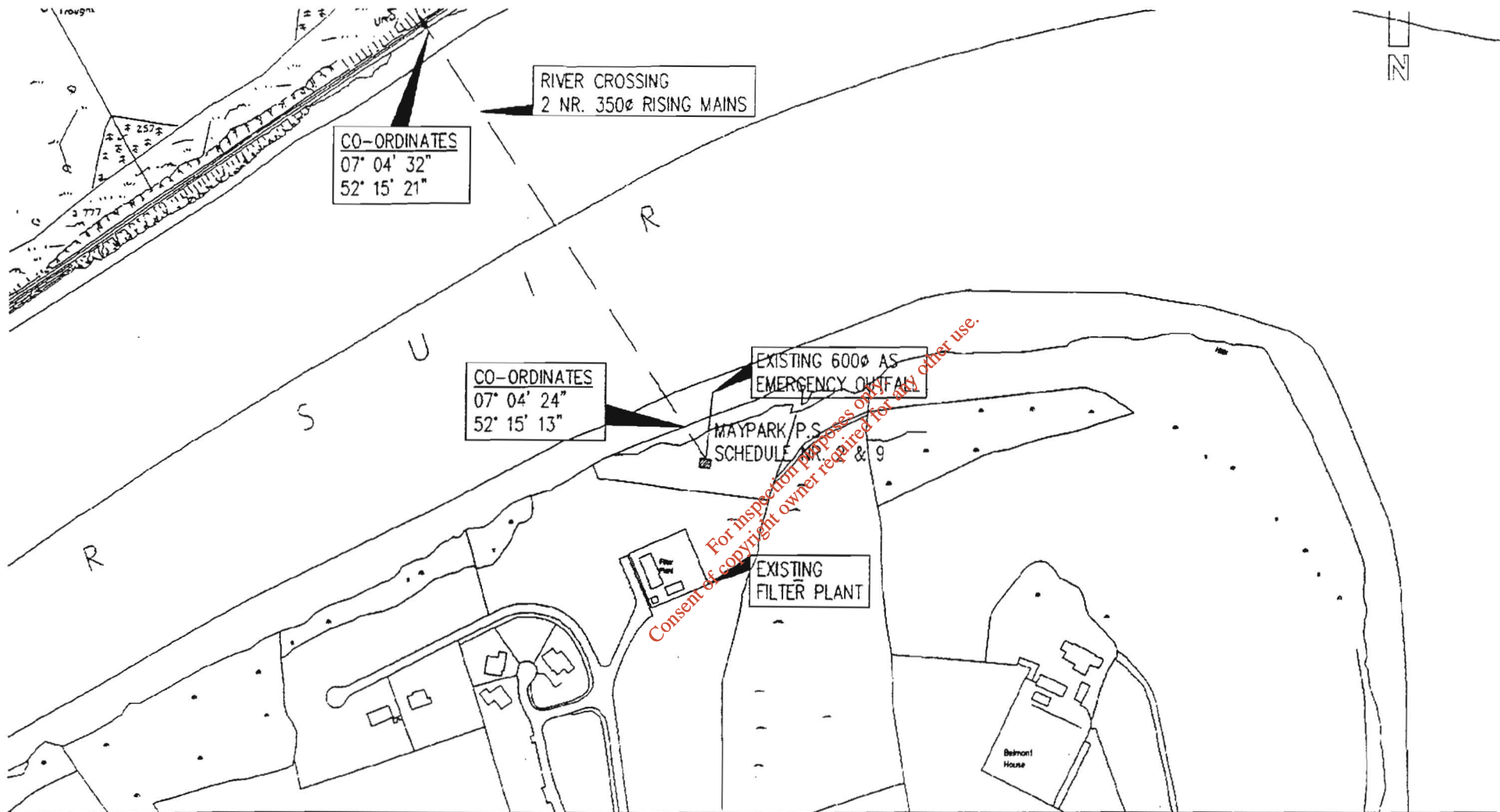


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NOTE: SEE DRG. NR. A3486-N215 FOR LONGITUDINAL AND CROSS SECTIONS

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	<small>CLIENT & PROJECT</small> WATERFORD CORPORATION WATERFORD MAIN DRAINAGE FORESHORE LICENCE APPLICATION

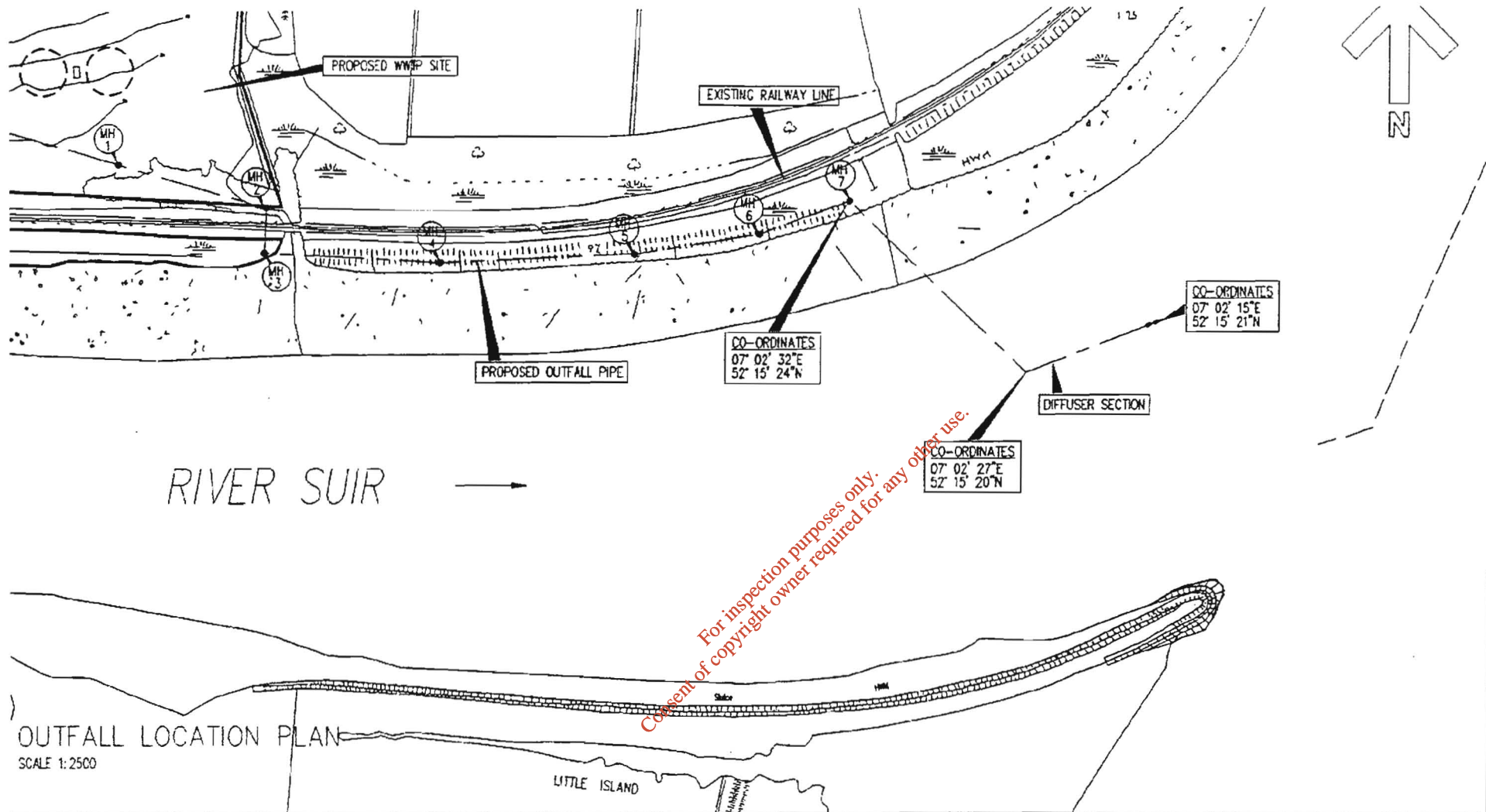
Fig 6 Waterpark Crossing



NOTE: SEE DRG. NR. A3486-N216 FOR LONGITUDINAL AND CROSS SECTION

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CLIENT & PROJECT		DRAWING TITLE	

Fig 7 Maypark Crossing



OUTFALL LOCATION PLAN

SCALE 1:2500

LITTLE ISLAND

<p>E. G. Peith & Company SPENCER HOUSE BLACKROCK ROAD CO. DUBLIN TEL. 01 221 89500 TELEFAX 01 221 986153</p>	<p>PROJECT & CONTRACTOR SUPERVISOR ROYALTY, COST CONTROL & ENVIRONMENT CONSULTANTS CIVIL & STRUCTURAL ENGINEERS & ARCHITECTS</p>
	<p>CLIENT & PROJECT BELVIEW WASTEWATER TREATMENT PLANT</p>

Fig 8 Belview Outfall



Plate 1



Plate 2



Plate 3



Plate 4

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Plate 5



Plate 6

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**MONITORING OF ENGINEERS TEST PITS
WATERFORD MAIN DRAINAGE, PHASE 2,
SOUTH KILKENNY.
LICENCE NO. 01E0959**

(MONITORING DURING SITE INVESTIGATION
BY GEOTECH - NOV 2001 TO FEB 2002)

ORLA SCULLY MA MIAI

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DC 5867 + amended conclusions

08.03.2002.

ROUTE OF PIPELINE S. KILKENNY

SHOWING TREATMENT PLANT IN RED

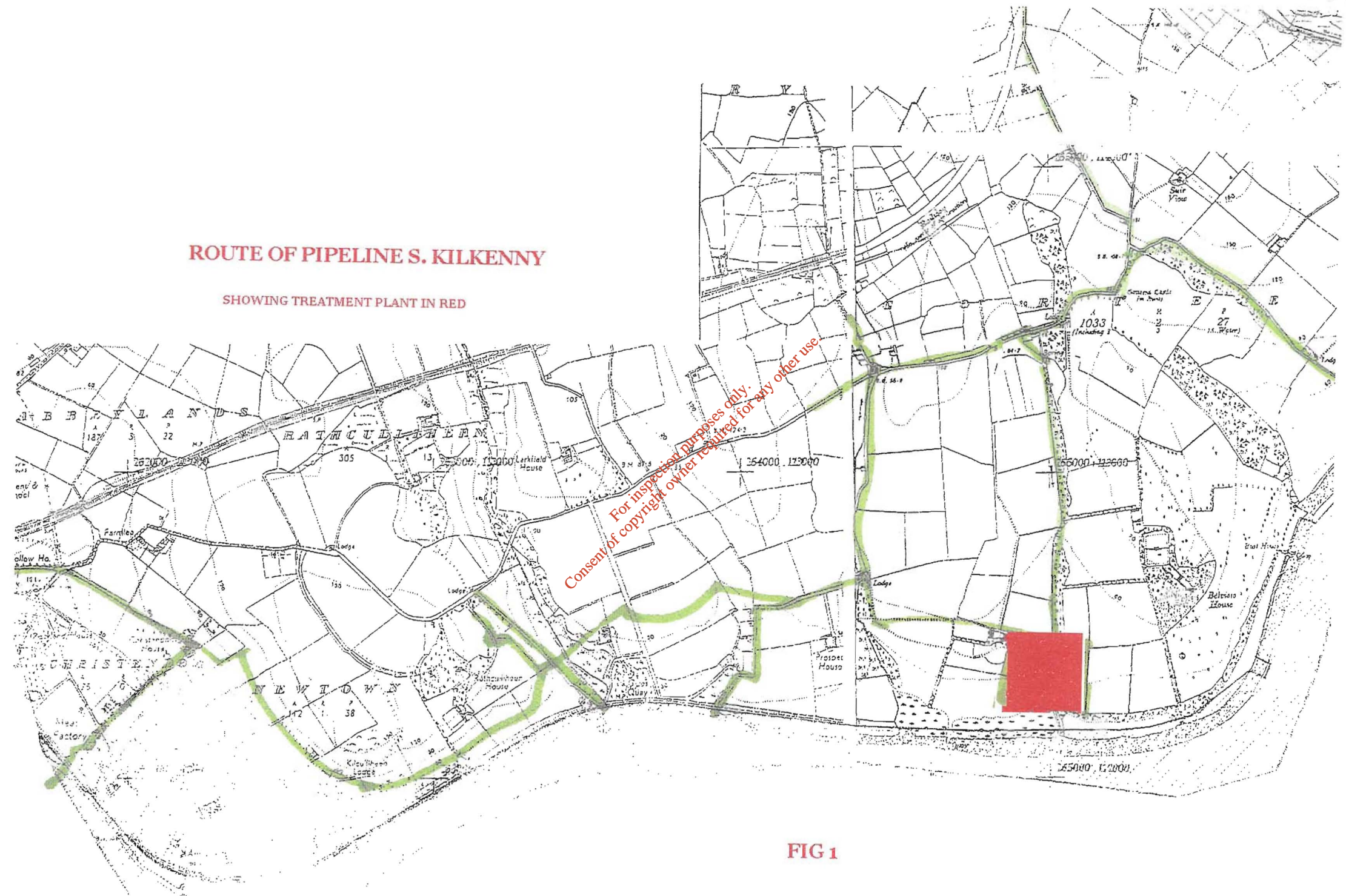


FIG 1