

**APPENDIX G**  
**Landscape Assessment**

*Bernadette O'Connell, Atkins McCarthy, Dublin Office.*

# YOUGHAL WASTE WATER TREATMENT WORKS

## VISUAL APPRAISAL PART A – GENERAL ASSESSMENT

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## 1. INTRODUCTION

- 1.1 This visual appraisal will form part of the site selection process for locating a Waste Water Treatment Works (WWTW) near to the town of Youghal in County Cork. The Appraisal is based on options shown in Drawing No.1721/411 Rev. B dated 06.03.01. The recommendations of the visual appraisal will be included within the project Environmental Impact Statement.

### PROPOSED DEVELOPMENT

- 1.2 The proposed development will be a Waste Water Treatment Works of approximately 2-3 hectares in size.

### SITE CONDITIONS

- 1.3 The proposed location for the WWTW is Youghal Mudlands, on the north side of Youghal between the N25 and the River Blackwater. The Mudlands comprise a flat area of wetlands and semi improved grassland approximately 61 hectares in size.
- 1.4 The site is divided along the north south axis by a farm access road with mature hedgerows either side. Three additional thin hedgerows run perpendicular to the farm access road and provide a further degree of visual screening across the site.
- 1.5 There are no protected views across the site however, a portion of the site along the eastern boundary is part of a proposed Special Area of Conservation (SAC) (Site Code 002170). The SAC is part of a wider Special Protection Area (SPA) which covers part of the adjoining estuary and extends further upstream.
- 1.6 In the northern corner of the Mudlands is a Landfill Site, a Proposed Extension to the Landfill Site and a Coal Depot. Along the western boundary of the

Mudlands there are several residential and industrial properties including a National Car Testing Depot and a Marble Works. On the eastern side of the Mudlands is a Public Right of Way along a raised sea wall, which starts at Dominic Collins place next to the Youghal Shipping Company and passes around the Landfill site in the northern corner of the Mudlands to join with the N25 opposite Muckridge Demesne.

- 1.7 The ground level of the Mudlands rises gently in a northerly direction towards the Existing Landfill Site. The low point of the site is in the south east corner adjacent to the Youghal Shipping Company where the land is approximately 3m below the adjacent N25. The path level of the Public Right of Way on the eastern side of the Mudlands is approximately 2m above the adjacent road (N25). The ground level of the Existing Landfill Site in the northern corner of the Mudlands rises to approximately 2m above the N25.

#### LANDSCAPE CHARACTER

- 1.8 The site comprises a series of fields and wetland areas surrounded by trees, hedgerows and ditches. In spite of the presence of an operational landfill in the north-eastern corner of the site the Mudlands are rural and tranquil in character and form part of a wider highly scenic estuary. The existing farm track and hedges which cross the Mudlands provide partial screening across the site, from the sea wall and for residential properties along the N25. Plant species within the hedgerows of the site include hawthorn (*Crataegus monogyna*), sycamore (*Acer pseudoplatanus*) and blackthorn (*Prunus spinosa*).

#### VISUAL ENVELOPE

- 1.9 The 'Visual Envelope' marks the approximate boundary of the zone of visual influence of the proposed development i.e. where the site would be visible during either construction or operation phase without visual mitigation measures in place. The Visual Envelope may be solid as in building edges or diffuse as in vegetation screens where filtered views are possible. Visually Sensitive Receivers are those people within the Visual Envelope who would experience adverse visual impact from the development.
- 1.10 Due to the relatively open and flat nature of the Mudlands and the undulating landscape enclosing the site on the north, west and eastern sides, the Visual Envelope of the Mudlands is extensive. However, roadside vegetation and mature hedgerows within the site limit views from certain locations. The Visual Envelope extends from properties in Dominic Collins Place to the

south, Upper Cork Hill to the south west and Greencloyne, Copperalley, Muckridge Demesne and Foxhole to the west.

- 1.11 The Land fill site in the north is the high point of the Mudlands and obscures views of the site from the viewing lay-by off the N25 on the approach to Youghal Bridge. Across the bridge on the eastern side of the estuary long distance glimpse views can be experienced for vehicle drivers and their passenger on the N25. The extent of the Visual Envelope is shown on Figure 1.1.
- 1.12 The general visibility of the Mudlands within the visual envelope is summarised in Figure 1.2- *Existing Conditions and Site Visibility*. Area A is the part of the site most visible to residential properties on the northern edge of Youghal and is between 100-600m from Dominic Collins Place. This area is bound on the north and western sides by hedgerows, the N25 southbound to the south and the Public Right of Way to the east. Although Area A is approximately 3 metres below the ground level of the adjacent housing, certain elements of the development i.e. aeration tanks (5m in height), sludge storage tanks (6m in height) and a control building (9m in height) would be highly visible and in close proximity to residential properties.
- 1.13 Area B is between the N25 and the hedgerows either side of the farm access road. This area is highly visible to the scattered properties in the rural areas to the east of the Mudlands. The ground level is approximately 2 metres below the adjacent N25 in the south and rises to the same height as the road in the north. Due to the proximity of the scattered rural housing along the N25 to this area, all elements of the development would be visible i.e. aeration tanks (5m in height), sludge storage tanks (6m in height), settlement tanks (3m in height), inlet screens (3m in height) and a control building (9m in height) and associated parking.
- 1.14 Area C is generally the area between the hedgerows of the farm access road and the Public Right of Way. It is the part of the site least visible to the residential properties around the perimeter of the Mudlands although it is visible from properties on the northeast facing slope off Upper Cork Hill and for users of the Public Right of Way. The centre of Area C is relatively isolated from surrounding Visually Sensitive Receivers and if located here the WWTW would benefit from the screening properties of the surrounding hedgerow. Visible elements of the development to the surrounding properties would be aeration tanks (5m in height), sludge storage tanks (6m in height) and a control building (9m in height).

### **Summary of location visibility**

- 1.15 The part of the mudlands which is visible to the least numbers of Visually Sensitive Receivers is the centre of Area C. Views into this part of the site are screened from residential properties to the south and west by the mature hedgerows either side of the farm access and field boundary hedgerows to the south. This area is visible to properties in elevated locations on adjoining hillsides but does not intrude significantly upon their wider view of the estuary.

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## 2. APPRAISAL OF POTENTIAL SITES

- 2.1 The Appraisal is based on options for the WWTW as shown in drawing No.1721/411RevB dated 06.03.01.

### Option 1

- 2.2 Option 1 is in the extreme south east corner of the Mudlands. The development would be highly visible to residents living in nearby properties i.e. Dominic Collins Place and Tallow Street and would obstruct their view across the estuary. Similarly vehicular drivers and their passengers on the N25 southbound would also have clear views into the WWTW and their long distance views of the estuary would also be obstructed. Users of the Public Right of Way along the eastern boundary of the Mudlands would also have a clear short distance view of the WWTW. Properties on the northeast facing slope off Upper Cork Hill would have clear long distance views of the site and the development would intrude upon their extensive view of the estuary. Due to the proximity of Option 1 to nearby residential properties and to the Public right of way it be difficult to successfully screen the WWTW in this location.

- 2.3 The southern end of the Mudlands is recognised as a local open space resource for Youghal. Located at Option 1, the WWTW would have a high impact on the landscape character of the Mudlands and the natural and open character of the Mudlands would be affected. Specifically the WWTW would require the removal of part of one of the mature hedgerows of the site and would be located on agricultural grazing land.

### Option 2

- 2.4 Location option 2 is also in the south eastern corner of the Mudland but directly adjacent to the Special Area of Conservation. The development in this location would also be visible to properties off Dominic Collins Place and Tallow Street and to vehicular traffic on the southbound N25. The mature hedgerow along the farm track within the site would part screen views of Option 2 from residential properties in the Greencloyne area. Due to the



distance of Option 2 from the urban fringe, the visual intrusion of the wider views of the estuary would not in general be as high as for Option 1. Users of the Public Right of Way along the eastern boundary of the Mudlands would also have a clear short distance view of the WWTW. Properties on the northeast facing slope off Upper Cork Hill would have clear long distance views of the site and the development would also intrude upon their extensive view of the estuary. Due to the proximity of Option 2 to the Public Right of Way it be difficult to successfully screen views into the WWTW from this pathway.

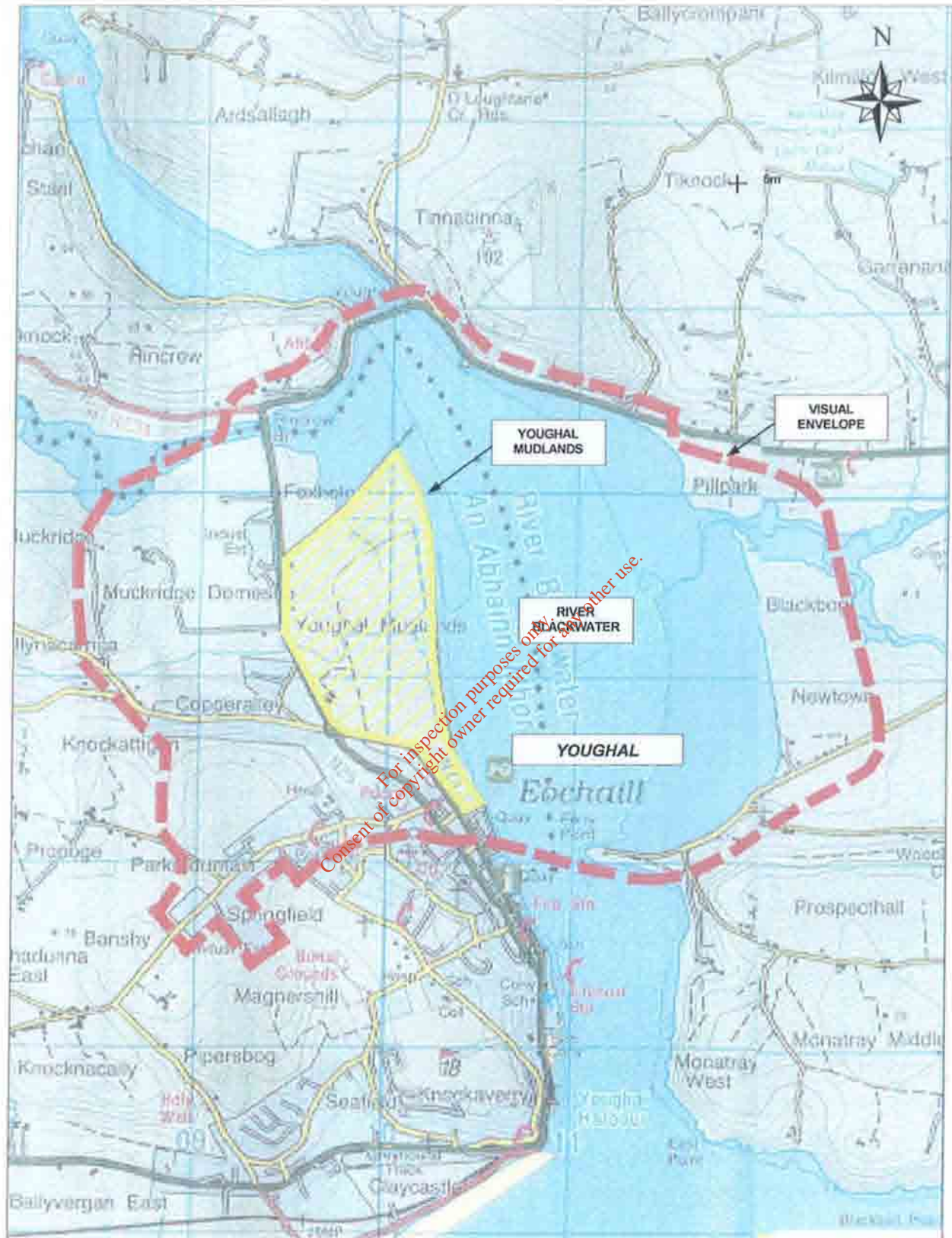
- 2.5 At Option 2 the WWTW would require the removal of a portion of two of the mature hedgerows of the site. Additionally, the WWTW in this area would reduce the natural, tranquillity of the Mudlands and reduce the quality of the area as an open space resource.

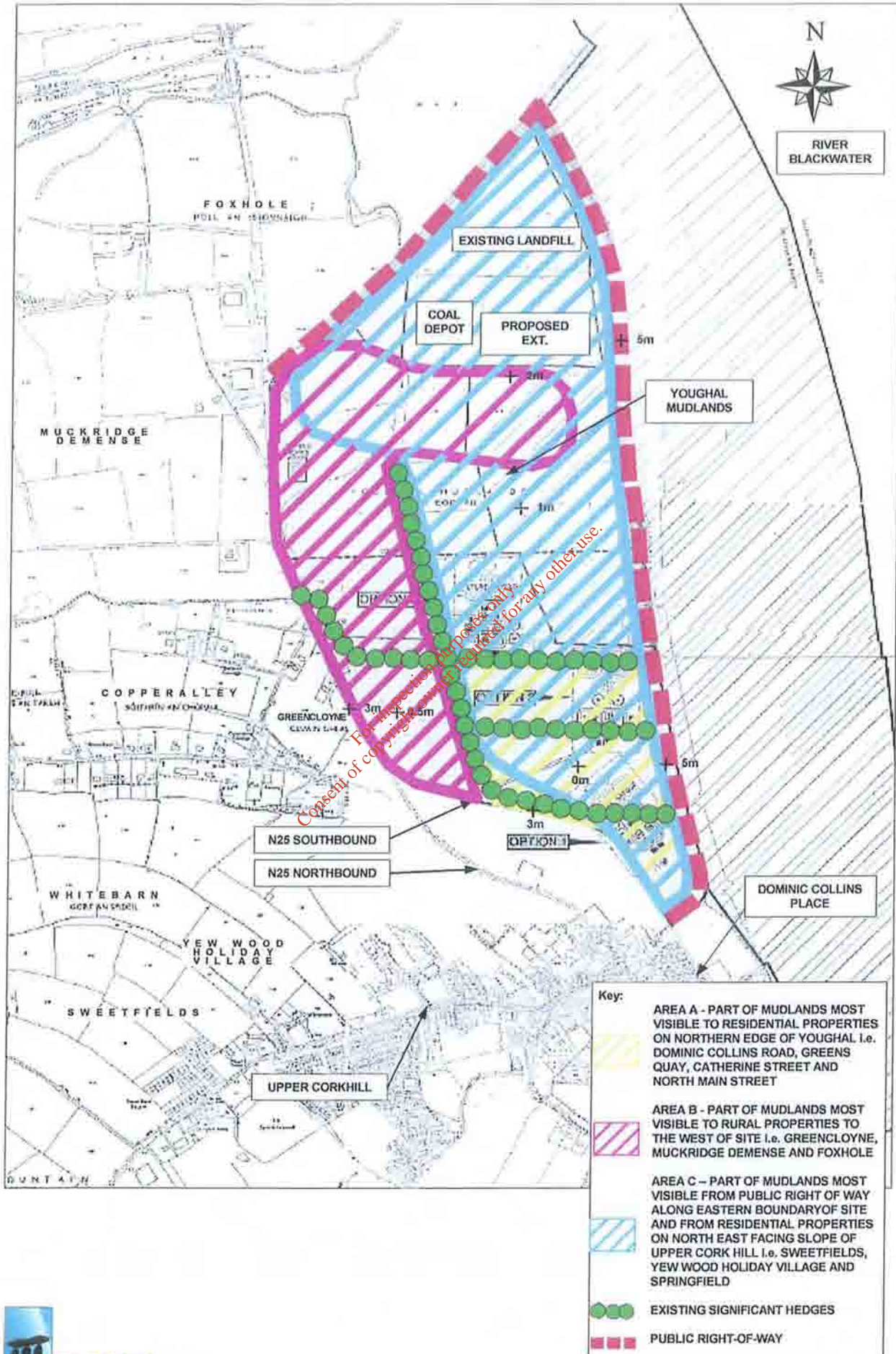
### **Option 3**

- 2.6 Option 3 is located in the centre of the Mudlands adjacent to the farm access road. The mature hedgerows along the farm track within the site would screen views of Option 3 from residential properties in the Muckridge Demesne, Copperalley and Greencloyne areas and those living in the northern part of Youghal. Users of the sea wall along the eastern boundary of the Mudlands would also have clear middle distance view of the WWTW, however the walkway would be separated from the WWTW by an area of wetlands included within the Special Area of Conservation. Properties on the northeast facing slope off Upper Cork Hill would have clear long distance views of the site although the development would not intrude upon their extensive view of the estuary.
- 2.7 Due to the central location of Option 3 it would be possible to successfully screen views into the WWTW from both the nearby residential properties and the sea wall. Long distant views from the elevated properties off Cork Hill cannot be screened from within the Mudlands but located within Option 3 the development does not create either an obstruction or an intrusion of their existing long distance view of the estuary.
- 2.8 At Option 3 no hedgerows would be removed for the development, although agricultural land would be lost. Location of the development in this area would also reduce the natural, tranquillity of the Mudlands and reduce the quality of the area as an open space resource. However, earth mounding and dense screen planting around the northern and eastern sides of the

development would reduce visibility of the WWTW from the Public Right of Way and minimise the landscape character of the area.

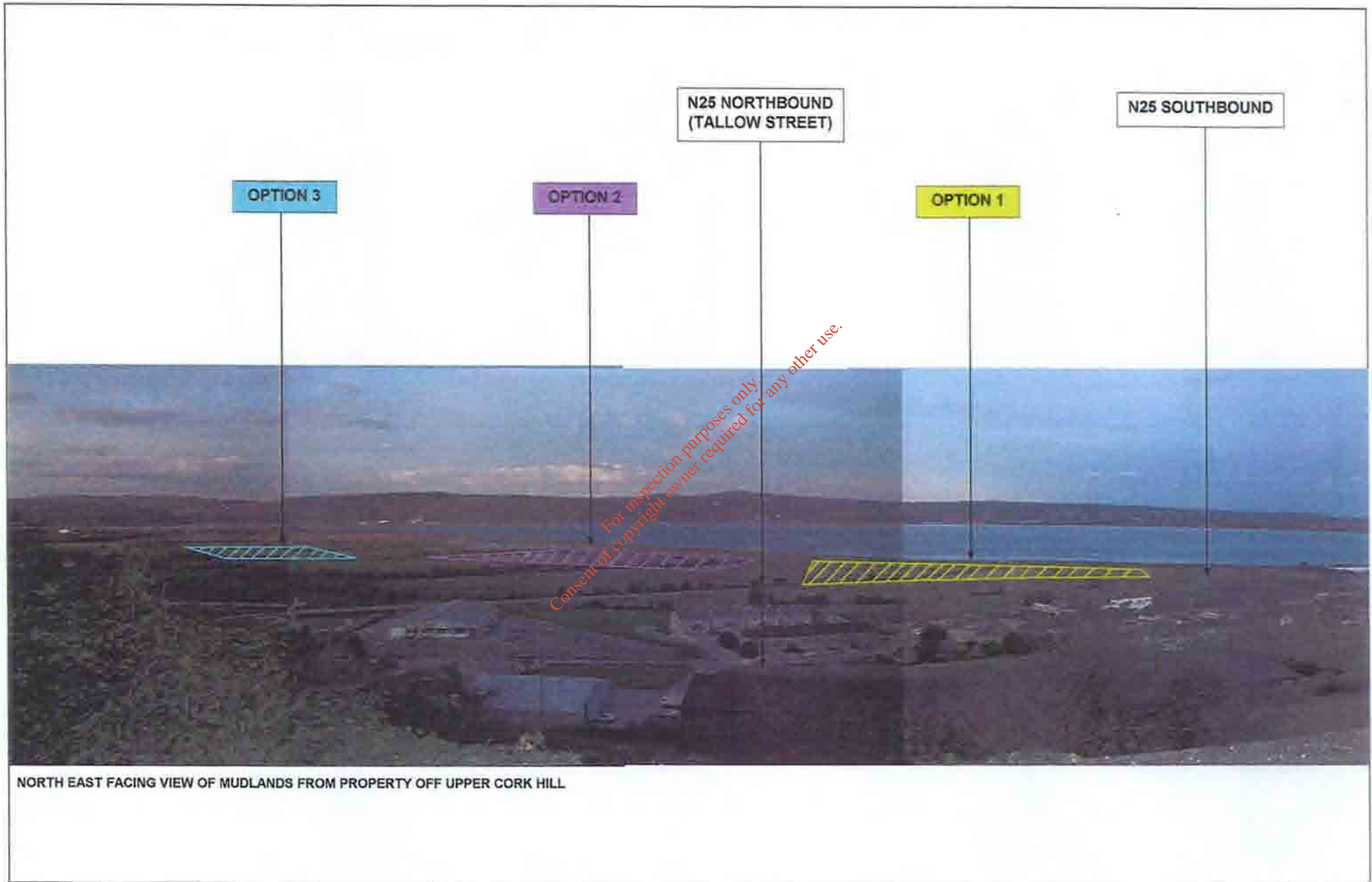
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EXISTING CONDITIONS AND SITE VISIBILITY

FIGURE G.2



NORTH EAST FACING VIEW OF MUDLANDS FROM PROPERTY OFF UPPER CORK HILL



### 3. SUMMARY AND RECOMMENDATIONS

- 3.1 In spite of the existing industrial development in the north east corner of the Mudlands, the area is rural, tranquil and scenic in character. The proposed development on Youghal Mudlands will have an extensive Visual Envelope. This is because the Mudlands is an open flat area adjacent to an estuary and is overlooked by residential properties on north east and north-west facing slopes.
- 3.2 Four options for the layout of the WWTW were proposed.
- Option 1 and 2 will have a high visual impact on Visually Sensitive Receivers in the adjacent housing area and properties on the north-east facing slopes off Upper Cork Hill. Option 1 and 2 will also have a high impact on the landscape character of the Mudlands. Mitigation measures to reduce visual impact at these locations will be difficult to achieve.
  - Option 3 is in the centre of the Mudlands. This area benefits from existing hedgerows to the western and southern side which offer partial screening. Screen planting on earth banks around the north and eastern side of this site would reduce visual impacts and minimise the effect on the landscape character.
- 3.3 Option 3 is the preferred location for the WWTW. Visibility of this area from surrounding properties is low and the area benefits from natural screening from mature hedgerows to the west and south. With additional screen planting on earth banks around the north and eastern side of this site the landscape and visual impacts on surrounding properties and the Public Right of Way will be low and generally acceptable.

# YOUGHAL WASTE WATER TREATMENT PLANT

## Landscape and Visual Assessment

### Part B – Site Option 3 Detailed Assessment

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## **LANDSCAPE AND VISUAL ASSESSMENT**

### **Introduction**

This section of the report outlines the landscape and visual impacts of the provision of a Waste Water Treatment Plant (WWTP) in the Youghal Mudlands at site option 3 as described in the site selection chapter of this Environmental Statement.

The assessment initially identifies the existing landscape features of the Treatment Plant as well as the features of the surrounding environment. The locations from where the development would be visible i.e. the visual envelope, are then described. People in the surrounding areas who would potentially be able to see the proposed development are identified i.e. visually sensitive receivers (VSR's), and categorised according to their predicted sensitivity to the visual intrusion or visual obstruction that would be generated by the proposed development.

The potential landscape and visual impacts that would result from the development are then identified and the level of the potential impacts are assessed according to the given methodology of the study described below. Measures are identified that would help reduce the level of these potential impacts on the landscape and on the identified visual receivers.

### **Figures and Plates**

The following figures and plates are referred to at various stages throughout this section:

Figure 1.1 Existing Landscape Features

Figure 1.2 Visual Envelope and Location of Visually Sensitive Receivers (VSR)

Figure 1.3 Landscape Proposals

Plate 1 View of site from VSR No. R1

Plate 2 View of site from VSR No. I1



Plate 3 View of site from VSR No. OS1

Plate 4 View of site from VSR No. R5

### **Approach**

The potential sensitivity of a visual receptor is primarily related to whether the person is at work, at play or at rest. Visual receptors may be broadly categorised into four groups as described below:

Those who view the impact from their homes (R) are considered to be highly sensitive as the attractiveness or otherwise of the outlook from their home will have a substantial effect on their perception of the quality and acceptability of their home environment and their general quality of life.

Those who view the impact whilst taking part in an outdoor leisure activity (OS) may display varying moderate sensitivity depending on the type of leisure activity. Football players, for example, would be less concerned with the quality of their surroundings than hill walkers. Similarly those who view the impact from community (C) facilities i.e. a hospital or a cemetery may display varying moderate sensitivity.

Those who view the impact from their workplace (I) are considered varying low sensitivity as the attractiveness or otherwise of the outlook will have a less important, although still material, effect on their perception of their quality of life. The degree to which this applies depends on whether the workplace is industrial, retail or commercial.

Those who view the impact whilst travelling on a public thoroughfare (T) will also display varying low sensitivity depending on the speed of travel and whether the view is continuous or occasionally glimpsed.

### **Existing Conditions**

The site for the WWTP is an area of wetlands and semi improved grassland in the centre of the Mudlands, specifically the area comprising two fields between the hedgerow of the farm access road and the edge of the Special Area of Conservation (SAC). The SAC is bound by the raised Public Right of Way along the eastern edge of the Mudlands and is shown on Figure 1.1 *Existing Landscape Features*.

## **Landscape Character**

The site comprises a series of fields and wetland areas surrounded by trees, hedgerows and ditches. In spite of the presence of an operational landfill in the north-eastern corner of the Mudlands the site and its surrounds are rural and tranquil in character and form part of a wider highly scenic estuary. The existing farm track and hedges which cross the Mudlands provide partial screening across the site, from the Public Right of Way and for residential properties along the N25. Plant species within the hedgerow along the western boundary of the site include hawthorn (*Crataegus monogyna*), sycamore (*Acer pseudoplatanus*) and blackthorn (*Prunus spinosa*).

## **Proposed Development**

The proposed development will be a Waste Water Treatment Plant of approximately 2-3 hectares in size. It is proposed to raise the ground level within the boundary of the site by 1-1.5m in order to sink certain components of the plant into the ground to reduce their visibility from the surrounding visually sensitive receivers. The proposed raised ground level will be 3m above sea level.

The individual elements of the Treatment Plant and their height above the proposed ground level are as follows:

- Aeration Tanks, 1.5m above ground level;
- Primary Settlement Tanks, 2m above ground level;
- Inlet Works, 3m above ground level;
- Control and Administration Building, 5m above ground level;
- Equipment Building between 5-8m above ground level dependant on single or two storey building to be decided at detailed design stage;
- Site Boundary Fence, 2.5m above ground level

## **Potential Landscape and Visual Impacts**

Potential sources of landscape and visual impact during the construction and operational phases are identified below.

### ***Construction Phase***

- Traffic movements;
- Cut and fill;
- Materials stockpiling, construction equipment and plant;
- Utilities, including water, drainage, power and lighting; and
- Temporary parking and on site accommodation and working areas;

### ***Operational Phase***

- Individual components of the WWTP;
- Equipment Building and Control/ Administration Building and associated parking; and
- Security fencing.

### **Visual Envelope and Visually Sensitive Receivers**

The 'Visual Envelope' marks the approximate boundary of the zone of visual influence of the proposed development i.e. where the site would be visible during either construction or operation phase without visual mitigation measures in place. The Visual Envelope may be solid as in building edges or diffuse as in vegetation screens where filtered views are possible. Visually Sensitive Receivers are those people within the Visual Envelope who would experience adverse visual impact from the development.

Due to the relatively open and flat nature of the Mudlands and the undulating landscape enclosing the site on the north, west and eastern sides, the Visual Envelope of the Mudlands itself is extensive. However, the site for the WWTP is adjacent to an existing mature hedgerow either side of a farm access lane as shown on Figure 1.1 *Existing Site Conditions*. The hedgerow provides a high degree of ground level screening for the properties to the west of the site.

The Visual Envelope extends from properties and vehicular traffic along the N25 between Muckridge Demesne and the Youghal Shipping Yard i.e. Visually Sensitive Receivers No.T2 R1, R2, R3, R4, R7, R10 I1, I4, I5, and I6. Also industrial, residential and community

properties off Upper Cork Hill i.e. VSR No.'s R5, R6, R8, R9, C1, C2, I1, I2, I3 and I7 to the south-west. Additionally users of the Public Right of Way VSR No. OS1 to the east would have views into the site.

The site is located in the base of the Blackwater River valley bordered to the west and east by hills. Short views into the site are possible from the properties along the N25 with east and northeast facing windows. The properties nearest to the site i.e. VSR No.'s R1 and R2 and users of the field to the west of the site (VSR No. I5) currently have their views into the site screened by the double hedgerow either side of the farm access lane as shown on Plate 1. It is not intended to remove this hedgerow as part of this project. However users of the Public Right of Way some 200m from the eastern boundary of the site and agricultural workers and grazing animals in the fields to the north south and east of the site (VSR No. I6), will have short distant open views of the development. Plate No. 3 shows the view towards the site from the Public Right of Way, VSR No.OS1.

Similarly properties shown as VSR No.'s R3, R4, R7, R10, I1, I3 and I4 will have middle distant views of the site, however again their views will be part screened by the existing significant hedgerows of the site. Plate No. 2 shows the view towards the site from VSR No. I1.

Long distance glimpse views are available from some properties and community facilities on the east facing hillsides overlooking the site off Upper Cork Hill i.e. VSR No.'s R5, R6, R8, R9, C1, C2, I1, I2, I3 and I7. Plate No. 4 shows the view towards the site from VSR No.C1.

The sit is not visible to properties outside the visual envelope i.e. properties in Foxhole, Muckridge Demesne, Whitebarn, Sweetfields and VSR No. R11-town centre

The location of visually sensitive receivers and the extent of the visual envelope are shown on Figure 1.2 *Visual Envelope and Location of Visually Sensitive Receivers (VSR)* and described in Table 1.0 at the end of this chapter.

## **IDENTIFICATION OF IMPACTS**

### **Construction Phase**

It is proposed that construction of the Plant will take place within the site and all storage of materials will be contained within the site boundary. The construction will require the creation of a new access road along the western boundary of two fields and removal of grass covering the site. No field boundary hedges will be removed and there will be no disruption to the Special Area of Conservation to the east.

During the construction process it is likely that temporary flood lighting will be required to improve visibility. The lighting columns and lamps will be visible and when in use will be a source of visual intrusion. There will also be activity associated with utilities to serve the new Plant and Buildings.

The increased traffic movement entering and leaving the site will be visible from all properties in and around the site and from those overlooking the site to the southwest. The activity and disruption resulting from the construction process will be confined to a small area of the site and much of the works will be screened by the early formation of perimeter earth mounds up to 2m in height.

People living in properties near to the site are the most sensitive receivers i.e. VSR No.R1 and R2. They will experience visual intrusion from the positioning of temporary buildings, flood lighting at night and by the traffic movement associated with the construction. However they are between 250-300m from the site and the existing hedgerow will provide a degree of temporary screening until long term planting on perimeter mounds reaches maturity. The short-term impact will be moderate negative. Users of the Public right of way are also sensitive to changes effecting the landscape character of the Mudlands. The construction period will change the tranquil and still atmosphere of the site and reduce the quality of the landscape.

A moderate negative impact will be also be experienced experience during the construction period by residents in properties off Upper Cork Road. These views although long distant will not be screened by the existing hedgerow and the activity associated with the construction of the Plant will be visible.

### **Operational Phase**

The proposed components of the Plant in particular the Equipment building between 5-8m in height will be visible over the existing mature hedgerow to the west and will cause some visual intrusion against the scenic backdrop of the hills on the eastern side of the estuary. At this early stage of the design it has not been determined whether a single or a two-storey building is required for the WWTP equipment. If a single storey building will suffice i.e. 5m in height, the visual intrusion will be minimal and the resulting overall visual impact will be low. If however a two-storey building is required the building will be visible over the existing hedgerow and cause a moderate visual intrusion for the visually sensitive receivers living near to the site. The resulting visual impact will be negative and medium.

Users of the Public Right of Way (VSR No. OS1) located some 200m from the eastern boundary of the site and agricultural workers and grazing animals in the fields to the north

south and east of the site (VSR No. 16), will have short distant open views of the development. The impact upon these users will also be negative and medium as the views from the site will not be screened by significant existing hedging.

Properties shown as VSR No.'s R3, R4, R7, R10, I1, I3 and I4 will have middle distant views of the site. However views from these properties will be part screened by the N25 which is on raised embankment approx. 3m above the existing site and approx. 1.5 m above the proposed ground level of the development. Due to the distance separating the site from these properties only the tallest elements i.e. the buildings of the site will be visible. The resulting impact will be negative and low.

Properties and community facilities on the east facing hillsides overlooking the site off Upper Cork Hill i.e. VSR No.'s R5, R6, R8, R9, C1, C2, I1, I2, I3 and I7 will not benefit from the screening properties of the existing hedgerows or the N25. All elements within the Plant including the hard standing areas will be visible, although from a distance and the visual impact will also be negative and low.

## **IDENTIFICATION OF MITIGATION**

### ***Construction Phase***

- Early positioning of the permanent earth bunds with advance planting
- Control of night time lighting using lighting baffles;
- Minimising height of temporary buildings;
- Minimise disruption to existing vegetation;
- Careful positioning of construction plant; and
- Control of dust using waters spray techniques.

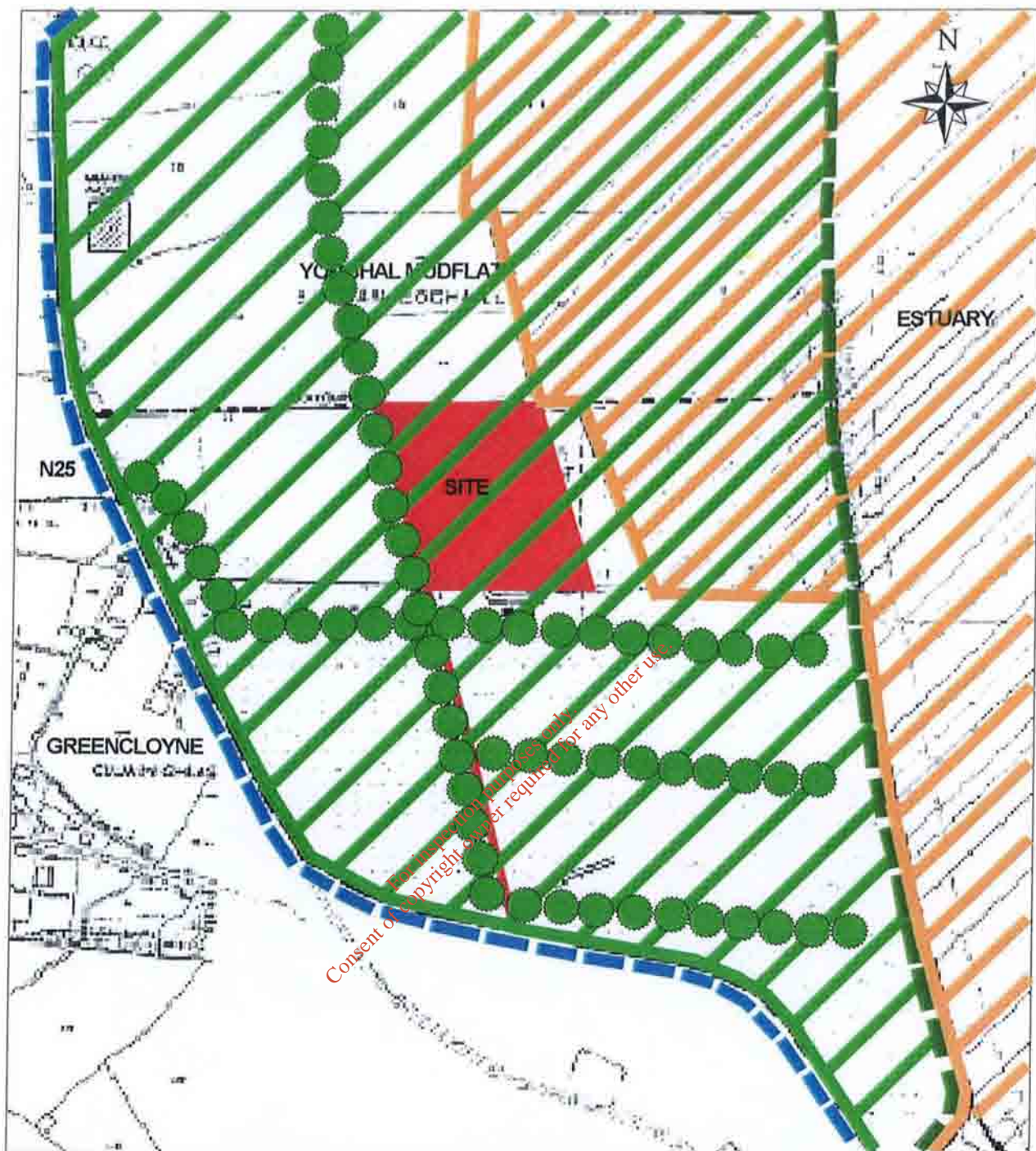
### ***Operational Phase***

To some degree the visual impact of the individual components of the Plant have been mitigated by their sinking into the ground thereby reducing the portion visible at ground level. However further mitigation by architectural and landscape treatment is recommended and includes the following:

- Careful use of materials (matt finish and non-reflective) for the Equipment and the Control/Administration buildings and individual components of the Plant. The choice of colour for materials for the building should match the earth tones of the surrounding wetland and deciduous vegetation. Similarly the perimeter fence should be finished in a dark colour to reduce its visibility when seen against the dark green of the perimeter planting.
- Indigenous wetland type planting with a high screening content on 2m high earth mounds surrounding the plant will reduce visibility from properties on surrounding flat land. Indigenous wetland type planting is recommended to match the colour and texture of existing planting and to survive the wet soil conditions. Soft landscape proposals to mitigate visual impacts are shown on Figure 1.3 *Landscape Proposals*.
- Due to the large number of properties overlooking the site (VSR No.'s R5, R6, R8, R9, C1, C2, I1, I2, I3 and I7) is it also proposed to include wide spreading tree planting within the grounds of the WWTP to reduce the visibility of the individual built elements of the Plant and of the hard standing areas from elevated view points.

## **IDENTIFICATION OF IMPACTS AFTER MITIGATION**

In both the construction and operational phases, the most significant impacts will be experienced by the residential properties located near to and overlooking the site, although the severity will be reduced after mitigation measures are applied. This will be achieved by applying the appropriate sensitive design with careful attention to materials and colour, screen planting on the earth bunds and wide spreading tree planting within the hard standing areas of the Plant.



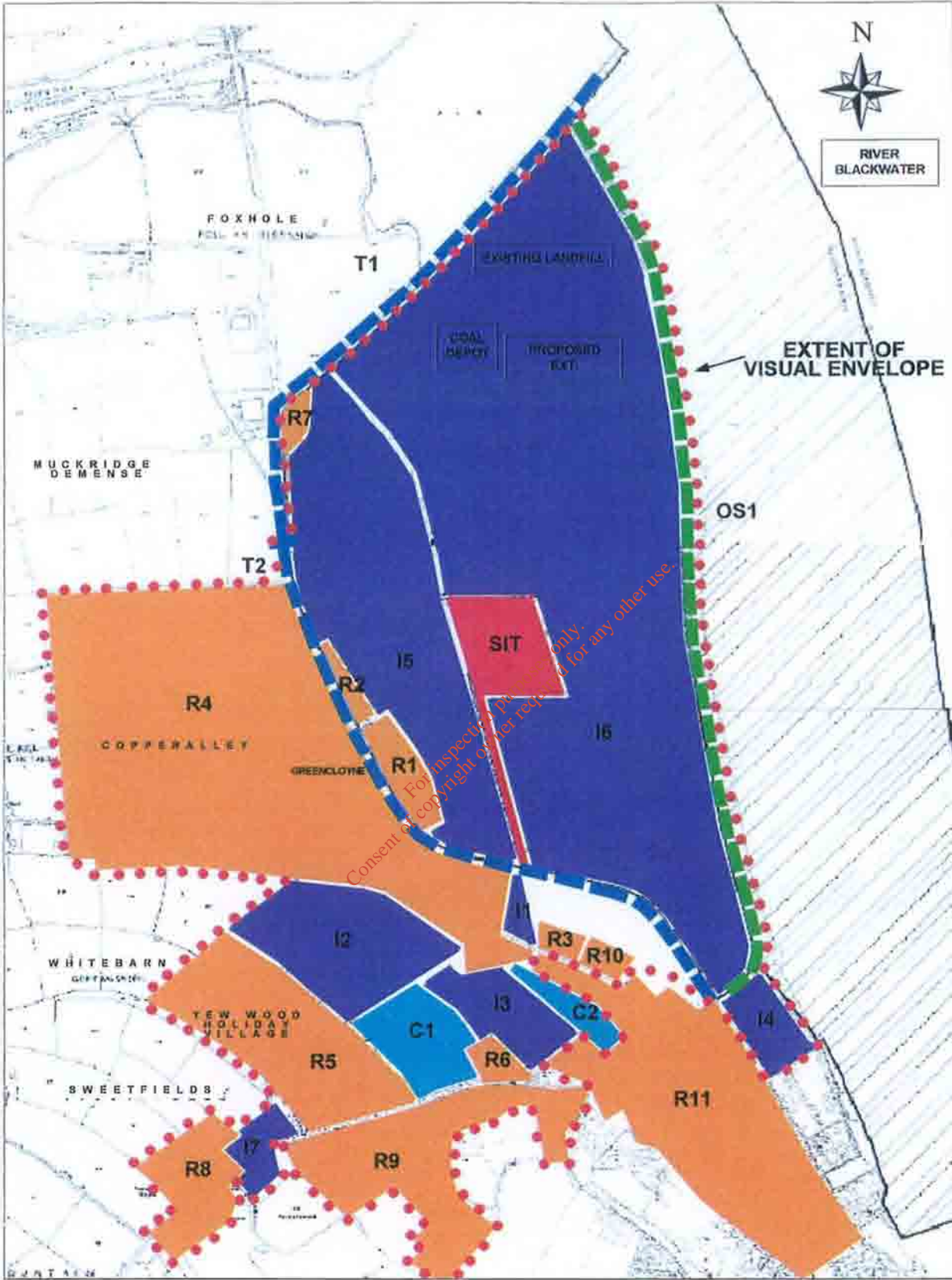
Key:

|  |                                      |
|--|--------------------------------------|
|  | WETLANDS AND SEMI-IMPROVED GRASSLAND |
|  | SPECIAL AREA OF CONSIDERATION        |
|  | RAISED WALKWAY                       |
|  | N25 ROAD                             |
|  | EXISTING SIGNIFICANT HEDGEROW        |
|  | SITE FOR WWTP                        |



EXISTING LANDSCAPE FEATURES **FIGURE 1.1**





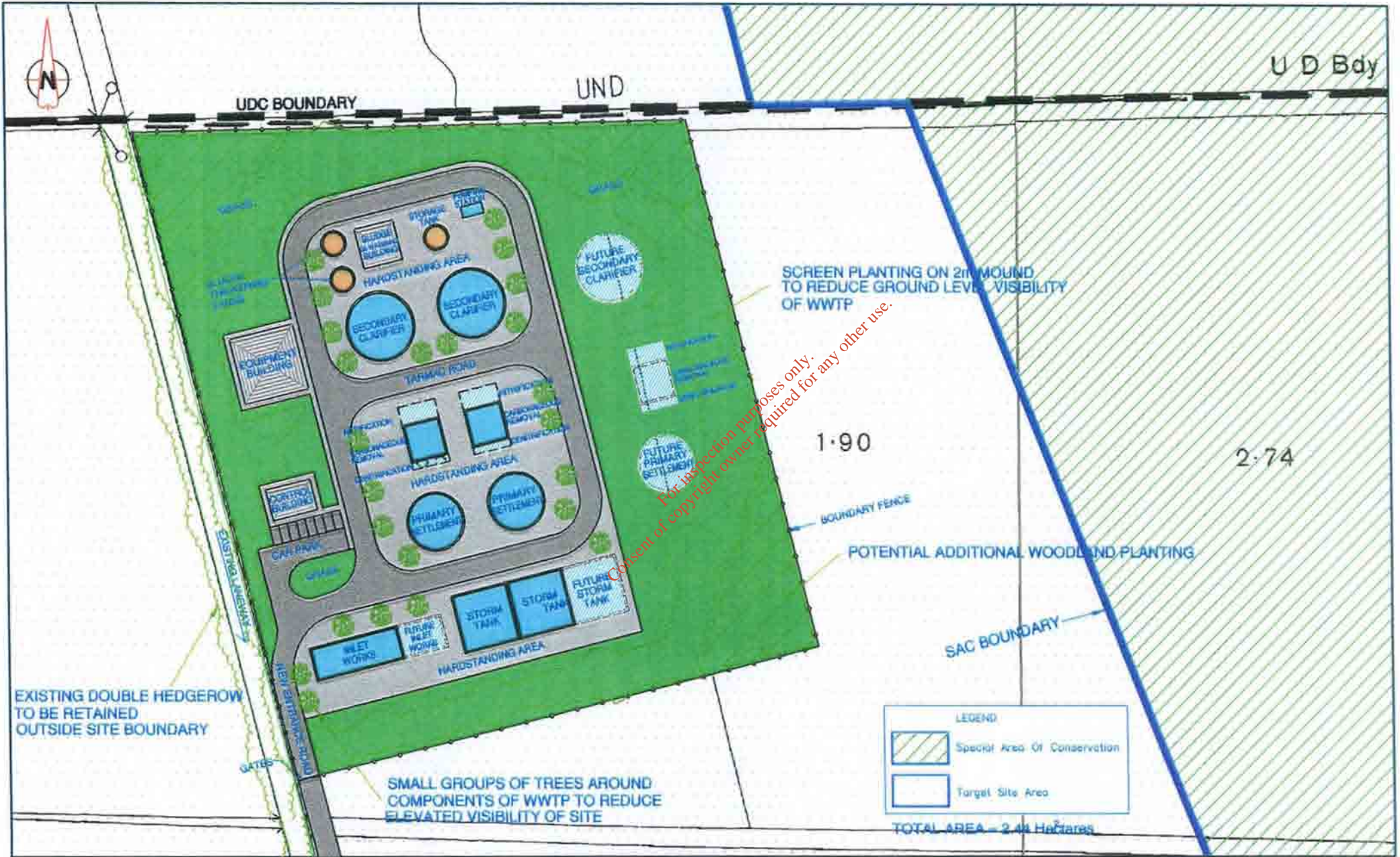
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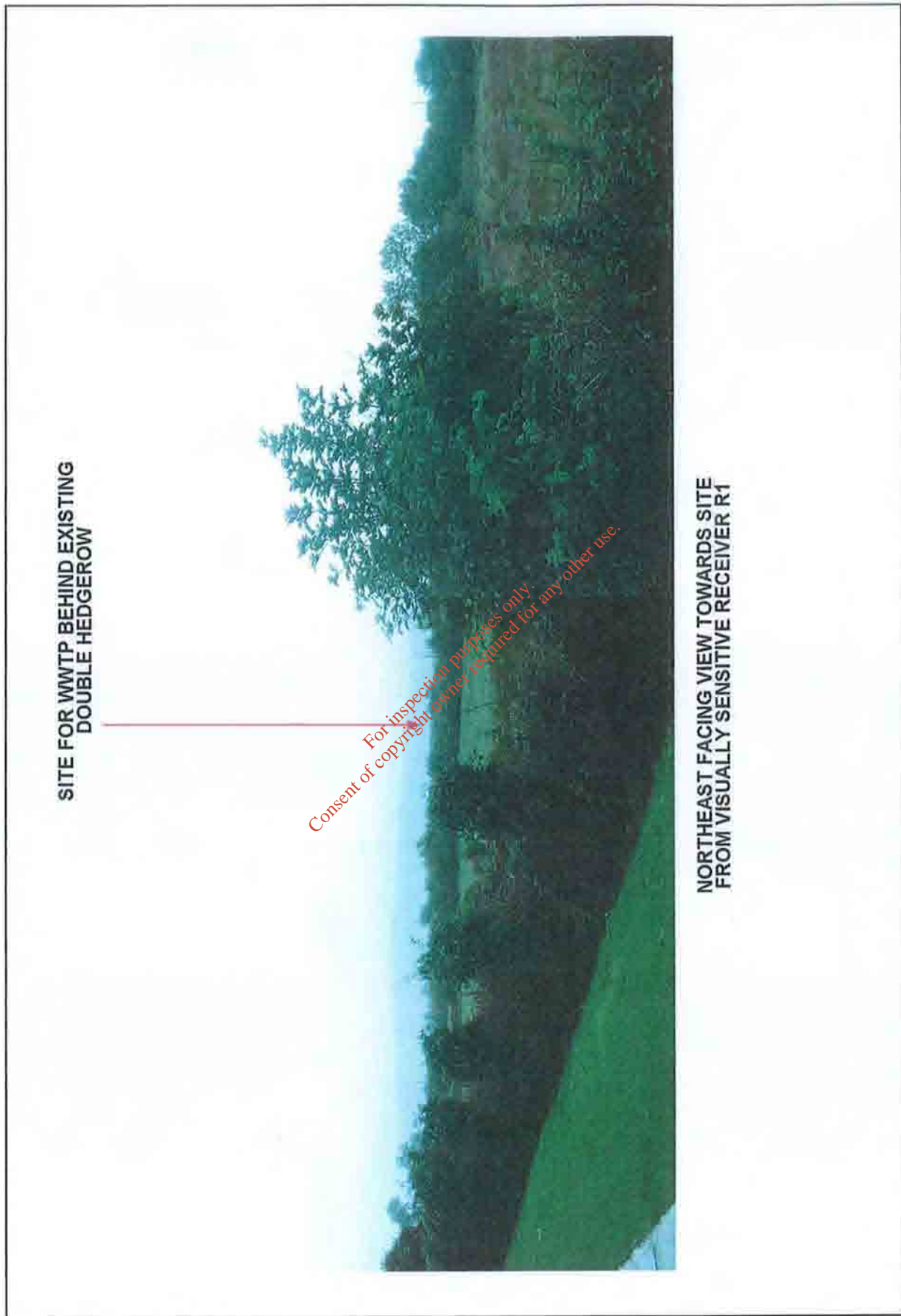
|   |                 |
|---|-----------------|
| <span style="color: blue;">■</span>   | INDUSTRIAL      |
| <span style="color: orange;">■</span>   | RESIDENTIAL     |
| <span style="color: green;">■</span>  | OPEN SPACE      |
| <span style="color: lightblue;">■</span>  | COMMUNITY       |
| <span style="border-bottom: 1px dashed blue; width: 20px; display: inline-block;"></span> | EXISTING ROAD   |
| <span style="border-bottom: 1px dotted red; width: 20px; display: inline-block;"></span>  | VISUAL ENVELOPE |

VISUAL ENVELOPE & LOCATION OF VISUALLY SENSITIVE RECEIVERS (VSR)

FIGURE 1.2









ENTRANCEWAY TO FARM ACCESS  
LANE ALONG WESTERN PERIMETER  
OF SITE

VISUALLY SENSITIVE RECEIVER

SITE FOR WWTP IN SUNKEN HOLLOW

N25 ON EMBANKMENT



NORTH FACING VIEW TOWARDS SITE FROM  
VISUALLY SENSITIVE RECEIVER 11

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SITE FOR WWTW HIGHLY VISIBLE FROM PUBLIC RIGHT OF WAY



WEST FACING VIEW OF SITE FROM PUBLIC RIGHT OF WAY (VSR No.051) ALONG EASTERN BOUNDARY OF MUDLANDS



**SITE FOR THE WWTP IN CENTRE OF YOUGHAL MUDFLANDS  
DEVELOPMENT OF THE WWTP WOULD NOT INTRUDE  
SIGNIFICANTLY UPON THE WIDER VIEW OF THE ESTUARY**



**NORTHEAST FACING VIEW OVER SITE FROM VISUALLY  
SENSITIVE RECEIVER C1**

## **APPENDIX H**

### **Cultural Heritage Assessment**

*Sheila Lane & Associates, Archaeological Consultants, Hazelhurst, Monkstown,  
Co.Cork*

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## H.1 Introduction

It is proposed to construct a Wastewater Treatment Works on the northern side of the town of Youghal and to realign the sewage system, storm and foul water, through the town, as required. An archaeological assessment has been requested in advance of the scheme to examine the impact of the development on the culture heritage of the area.

This report was undertaken by Avril Purcell of Sheila Lane & Associates Consulting Archaeologists, Church Road, Carrigaline, County Cork on behalf of Atkins McCarthy, Consulting Engineers, Villa Franca, Douglas Road, Cork for Cork County Council.

## H.2 Proposed Development

The Youghal Main Drainage Scheme involves the construction of a treatment plant at one of three possible locations. The three possible locations are to the north of Youghal town centering on the reclaimed mudflats along the western bank of the Blackwater Estuary and the adjoining land which flanked the mudflats, prior to reclamation (Figure H.1). This area, in which the three options for this treatment plant are located, is referred to as the *Target Site Area*. The three possible locations are on reclaimed land in Youghal Mudlands townland. The quality of this land is poor; all is in pasture and much of this is rough pasture.

The northern edge of the Target Site Area is bordered by a landfill occupying a triangle of land approximately 1.5km from the town. The Blackwater River Estuary is located to the east; a large section of the land between the Target Site Area and the river is designated as a Special Area of Conservation. A sea wall has been constructed between the river estuary and the reclaimed land, this is several meters high and a walk runs along the top of it. To the west the Target Site Area is defined by the N25 road from Youghal to



Dungarvan. To the west of this road the quality of the land improves. The southern end of the Target Site Area is defined by a modern road constructed probably within the last ten years which cuts through the three most southerly fields in the Target Site Area (Fields, 19, 20 and 21). This recently constructed road runs from the northern part of Youghal town to the N25 (Figure H.1).

There are three possible locations for the treatment plant (Figure H.1); Option 1 is located at the southern end of the Target Site Area and at the southern end of Youghal Mudlands on the shore of the Blackwater estuary and just north of the town's quay. This possible site is close to the northern end of the town and would be accessed from the new road into the northern part of Youghal.

Option 2 is situated in Youghal Mudlands north of Option 1 on the eastern boundary of the Target Site Area. Option 3 is situated just south of the UDC boundary area and would be accessed directly from the N25.

### H.3 Study Methodology

A study of the archaeological environment within c. 1km of the Target Site Area was carried out to assess the archaeological heritage of the area. The archaeological assessment is based on a desktop study and a field inspection and included the following components:

*Sites and Monuments Record (SMR)* - This record, compiled by Dúchas, formerly OPW, is a list of all known archaeological sites and monuments in each county. The SMR (Sites and Monuments Record) numbering system is used in this report. It consists of two parts: the first part is the county code (CO for Cork) followed by the Ordnance Survey map number (6" to the mile scale); the second part is the number of a circle surrounding the site on the SMR map e.g. CO067-023--- refers to circle 23 on OS sheet 67 for County Cork.

*Archaeological Inventory of County Cork* - This is the follow-up phase to the SMR, where all sites listed in the SMR were visited and a rapid survey of each site was carried out. The *Archaeological Inventory of County Cork Vol II East & South Cork* (Power, 1994) was used for this assessment.

*Record of Monuments and Places (RMP)* - This record was established under Section 12 (1) of the National Monuments (Amendment) Act 1994. It post-dates the SMR and lists all monuments and places believed to be of archaeological importance in the county. It was published in 1998.

*Files of the Archaeological Survey of Ireland, Dúchas* - The Archaeological Survey of Ireland carried out the SMR, RMP and published the *Archaeological Inventory of County Cork*. The files of the survey are constantly updated and sometimes contain additional information to the published data as well as information on newly discovered sites.

*Documentary Sources* - All available literary references were consulted. These included local histories and relevant journals of the Cork Historical and Archaeological Society. The first second and third editions of the O.S. 6" maps were also used.

#### *Field Walking*

Permission was granted by Cork County Council, through Atkins McCarthy, to walk the Target Site Area including the area of interest of the four possible locations for the treatment works. Field walking was undertaken by Avril Purcell and Margaret Shine on the 29<sup>th</sup> March 2001. Protective clothing was worn and full disinfection procedures were undertaken with due regard for foot and mouth restrictions.

## **H.4 Historical Background**

The historical background of both the Target Site Area and town of Youghal are examined chronologically to assess the impact of the development of the proposed

treatment plant in the Target Site Area as well as Youghal town, as pipes may be laid through the town. Sites within approximately 1km of the Target Site Area and those impacted by the proposed route of the pipes through the town were examined.

The earliest site within the study area is probably the standing stone in Muckridge townland (CO067-071---) located 600m north-west of the Target Site Area. Standing stones were first erected in the Bronze Age but they may date to any period between the Bronze Age and the present. They were erected in more recent times as scratching posts for animals. These standing stones may have served as prehistoric burial markers or boundary markers *etc.* along ancient routeways. Many prehistoric standing stones are aligned north-east by south-west possibly indicating a close affinity with stone rows and pairs and suggesting they date to the Bronze Age (Power, 1994, 9).

Over a kilometre south-west of the medieval walled town (Figure H.3) Saint Coran's Well survives in Seafield townland (CO067-049---). Proposed pipe laying will impact on the Zone of Archaeological Potential of this site, but not on the site itself. Holy wells can be found associated with church sites but many are isolated. The antiquity of most of these wells is difficult to determine as they can date back to the Early Christian period. The patterns and rituals associated with many of them were suppressed in the early nineteenth century but many of these have been revived since (Moore, 1999, 200). Saint Coran's Well is a stone built ornate gabled structure, with a cross incised towards the top of it. The pilgrimage there was revived in 1975 (Power, 1994, 178). A short distance south-east of the holy well there was a milestone on the roadside in Summerfield (CO067-040---). The Zone of Archaeological Potential of this site will be impacted by proposed pipe laying.

The name Youghal means 'a wooded place' suggesting when the area of the town was initially settled it was dense forest (Lewis, 1837, 434). Historical evidence indicates the town was first settled by the Vikings in the 9<sup>th</sup> century, however the earliest known archaeological evidence for the town is from the Anglo-Norman period, the 13<sup>th</sup> century.

The town was walled by the 13<sup>th</sup> century and substantial evidence of the wall survives. The walls were well maintained throughout much of the medieval period and several different building phases are apparent (Zajac *et al*, 1995, 91-92). The entire circuit of the wall is known; firstly through its excellent, though partial, survival and secondly from cartographic evidence, in particular the existence of two early maps of the town (c. 1587 and 1602). The wall enclosed a roughly rectangular area oriented north-west by south-east (Figure H.2). At the south-western side a small base town adjoined the town wall, this was named 'Parkapika' on the 1933 6inch OS map (CO067-058---) (Zajac *et al*, 1995, 103). Thomas (1992) suggests the base town may have originated as a bailey around a medieval Desmond house; it may have been walled to strengthen its defences because it was inadequately defended otherwise (1992, 219). It has also been suggested that the base town may be the earliest portion of the town originally on the site of the Viking settlement. On the other hand, Buckley (1900) suggested that the core of the walled town may be sited on the Viking settlement and the lowest level of the town wall may be Viking (Thomas, 1992, 219).

The medieval street plan survives in the town. There is a double-linear street plan of two long streets, one of which is the main street, running parallel to the town walls and connected by lanes (Figure H.2). Three of the town gates traversed the main street (North Main Street and South Main Street) North Gate, South Gate and Clock or Trinity Gate which became an internal gate to base town and was rebuilt in 1777 (Thomas, 1992, 217).

The RMP for County Cork lists a large number of archaeological sites within the historic walled town of Youghal (CO067-02901-) (Figure H.3). These include the town wall (CO067-02902-), church and graveyard (CO067-02903- and 02904-), graveyard and friary (CO067-03001- and 03002-), a church (CO067-061---), three town houses (CO067-02905-, CO067-02909- and CO067-048---), college (CO067-02906-), almshouse (CO067-02907-), three urban tower houses (CO067-02908-, CO067-02915- and CO067-064---), abbey (CO067-02910-), town gate (CO067-02911), water gate (CO067-02912-), mansion house (CO067-02913-), two court houses (CO067-02914- and

CO067-045---), meeting house (CO067-046---), two market houses (CO067-062--- and CO067-067---), market cross (CO067-063---), school (CO067-068---) and a burial ground (CO067-069---). These sites are located within the Zone of Archaeological Potential for Youghal in Youghal-Lands townland between 50m and 800m south of the Target Site Area. Pipe laying within the town may affect some of these sites.

There are a number of archaeological sites to the south and west of the walled town which may be impacted upon by pipe laying (Figure H.4). Approximately 150m south of the walled medieval town there is the site of a friary (CO067-02801-). The Zone of Archaeological Potential of this site will be impacted upon by proposed pipe laying. The friary was founded in 1224 by Maurice Fitzgerald (Figure H.3). No visible remains of this site now survive; only traces of it remained by 1681 (Power, 1994, 282). An architectural fragment was recovered from this area also (CO067-02802-). There was a mill (CO067-065---) directly west of the friary and 150m south of the medieval walled town. Both the friary and the mill are located in Youghal-Lands townland.

Approximately 800m south of the medieval walled town in Knockaverry townland (Figure H.4) the Zone of Archaeological Potential of two sites will be impacted upon by proposed pipe laying *i.e.* a nunnery (CO067-027---) and a lighthouse (CO067-066---). The nunnery was founded on the site *c.* 1190. By 1644 the convent was no longer standing but a circular tower, known as St. Anne's Tower' survived. The remains of the tower were demolished in 1848 to build the lighthouse (Power, 1994, 282).

There are a number of country houses within 1km of the Target Site Area (Figure H.4). In Muckridge Demesne a country house (CO067-008---) is located 800m west of the development site. A country house (CO067-01102-) is located 1km west of the development site in Muckridge townland. The house, known as 'Heathfield Towers', is a late eighteenth /early nineteenth century building. The house was elaborately extended in the mid nineteenth century. It was burnt in 1935 and is now only partially occupied (Power, 1994, 328).

About 300m north of the walled town and 100m west of the Target Site Area the remains of a country house called 'Rock Lodge' (CO067-038---) are located in Youghal-Lands which may be impacted upon by pipe laying (Figure H.3). The house was visited by the Cork Archaeological Survey in 1983 at which time it was roofless. The house is late eighteenth /early nineteenth century date and overlooks Youghal Harbour (Power, 1994,329).

The Zone of Archaeological Potential for the gasworks located at the northern end of Youghal town (CO067-031---) extends into the southern portion of the Target Site Area. The surrounding wall of the gasworks has a date of 1830 carved on its western elevation. On the 1842 6-inch map, prior to land reclamation, it is depicted on the seafront at the north end of Youghal town. The building was demolished in the late 1980s (Power, 1994, 361). The site was inspected as part of this assessment; most of the remains of the gasworks have been removed although some of the buildings are still standing in a dilapidated state. The gasworks was defined by a substantial stone wall which remains and now encloses a works yard for Cork County Council.

In Greencloyne, 200m west of the development site, there is a one-story vernacular house (CO067-037---) which is known as 'Mistletoe Cottage' (Figure H.3). This is a five-bay, L-shaped house and was occupied when visited by the Cork Archaeological Survey in 1983 (Power, 1994, 346).

A 'pottery clay mill' or pottery works stood close to the country house 'Heathfield Towers' in Muckridge, 1km west of the Target Site Area (CO067-01101-) (Figure H.4). Much of the site is now in ruins and heavily overgrown (Power, 1994, 359).

'Youghal Brick Works' (CO067-012---) were located 600m north-west of the Target Site Area in Muckridge. A portion of the late nineteenth /early twentieth century kiln to the brick-works survives on the site (Power, 1994, 360).

The 1842 1<sup>st</sup> edition OS map (Figure H.5) records a number of fish weirs along the banks of the Blackwater, although none are shown in the Target Site Area. These were in use into the first half of this century and may have been in these positions for many hundreds of years previously. The Cork Archaeological Survey files contain a written record of the use of these weirs during the First World War. Intertidal archaeological surveys of river estuaries in other parts of the country have shown that this type of fish weir was used in medieval times and earlier.

## **H.5 Cartographic Evidence**

The Target Site Area, in which it is proposed to construct the treatment plant, is located north of Youghal on reclaimed mudflats between the Tourig and Blackwater Rivers (Figure H.1). The Target Site Area incorporates a large portion of Youghal Mudlands and smaller portions of the adjoining townlands of Foxhole and Greencloyne. Youghal Mudlands townland was reclaimed from the Blackwater Estuary, the reclamation of this land can be traced by studying the three editions of the OS 6 inch maps. The 1842 1<sup>st</sup> edition OS map (Figure H.5) shows tidal mudflats on the western side of the River Blackwater, while Foxhole further to the west is agricultural land with field boundaries represented. The 1902 2<sup>nd</sup> edition OS map shows the tidal mudflats to be reclaimed encompassing an area of c. 1200 square meters which is divided into fields (Figure H.6). It is given a townland designation and named Youghal Mudlands.

There are no known archaeological sites within the Target Site Area; given how recently the area was reclaimed this is not surprising. Mud was removed from the mudflats during the 18<sup>th</sup> and 19<sup>th</sup> centuries for use in the pottery and brickworks of Youghal. A number of potteries operated in the area and some of the buildings associated with the trade still survive although the potteries themselves have long since gone out of business. Clay is still taken from the mudflats to make the present day Youghal pottery.

## **H.6 Field Inspection**

The field inspection was undertaken on the 29<sup>th</sup> March by Avril Purcell and Margaret Shine. Each field was numbered (Figure H.3) and was walked to assess any potential archaeological features or sites. Field boundaries in the area have been modified, some have been removed and some added. A rough grassy track runs north south through much of the area. Land is very low lying and land drains define the edges of most of the fields in the area, land quality is poor and all is under pasture.

### **H.6.1 Field 1**

In Youghal Mudlands townland, Field 1 has been reclaimed. On the eastern side of the grassy track, this extensive east-west field is under rough pasture, it is very wet and boggy (Plate H.1). Visibility was poor due to extensive growth of bog grass. No features of archaeological significance were apparent in the field.

### **H.6.2 Field 2**

On the eastern side of the grassy track Field 2 has been sub-divided into three fields of almost equal size running north south (Plate H.2). The land is under rough grazing, and is wet and boggy. At the northern end of the three fields the land is slightly raised and thus drier. This was probably built up by the landowner to provide a dry walking track across the field. Visibility was poor due to extensive growth of bog vegetation. No archaeological features or finds were noted. Field 2 was reclaimed and is in Youghal Mudlands townland.

### **H.6.3 Field 3**



On the eastern side of the grassy track, Field 3 is oriented north south (Plate H.3). It is a relatively well-drained field under pasture with just minimal growth of bog vegetation. The field has been reclaimed and is in Youghal Mudlands. No features of archaeological significance were noted.

#### ***H.6.4 Field 4***

Field 4 is accessed through Field 3 and to the east the Special Area of Conservation is located. There is no field boundary between Field 4 and the conservation area. The field is under rough grazing. Field 4 was reclaimed and is in Youghal Mudlands. No evidence of archaeological features was noted.

#### ***H.6.5 Field 5***

On the eastern side of the grassy track Field 5 is under rough grazing (Plate H.4). This field has been reclaimed from the sea and is in Youghal Mudlands townland. It is wet in places but there is little growth of bog vegetation. There is a cattle crush at the south-western corner, just inside the gate accessing the field from the track. Material has been brought into the area of the cattle crush to raise the ground level, this included brick fragments and two pieces of dressed stone. (Fields 6, 7 and 8 are within the Special Area of Conservation and thus are not included in the study).

#### ***H.6.6 Field 9***

To the north of the grassy track, Field 9 is oriented north-south. It is wet underfoot with substantial growth of bog vegetation. Field 9 is in Youghal Mudlands and has been reclaimed. The northern adjoining field contains a coal depot, and the eastern adjoining field is within the Special Area of Conservation. The western boundary of the field is the townland boundary. Prior to the reclamation of Youghal Mudlands this townland

boundary defined the edge of the Blackwater estuary. It is a substantial, faced, earthen bank (Plate H.5). The facing on the bank is of stone and brick. A narrow overgrown track (probably a continuation of the previously described grassy track) runs behind the boundary to the west and a low bank defines the track on the other side. The track is only accessible in one location otherwise it is completely overgrown. Several burnt tree stumps were visible in this field. These stumps were probably washed up or collected from the estuary and left in this field. The burning of the stumps was probably an effort by the landowner to dispose of them.

#### ***H.6.7 Field 10***

This has now been amalgamated into Field 11 below.

#### ***H.6.8 Field 11***

On the eastern side of the N25 Youghal - Dunganarvan road, Field 11 is in rough grazing (Plate H.6). Bog vegetation is very dense and visibility is poor. There were no archaeological features apparent in this field. There is a private house at the western edge of the field and a government building at the north-western edge. Field 11 is in Foxhole townland, it has not been reclaimed, but was previously on the shore of the Blackwater Estuary.

#### ***H.6.9 Field 12***

On the eastern side of the N25, Field 12 is a large irregular pasture field with a substantial, steep-sided drain running through it (Plate H.7). Field 12 is in Foxhole and prior to reclamation was previously on the shore of the Blackwater Estuary. No archaeological features were apparent.

#### ***H.6.10 Field 13***

On the western side of the grassy track and east of the N25 field 13 is a large irregular poorly drained field of rough pasture (Plate H.8). There is extensive growth of bog vegetation and brambles. Visibility is poor, no archaeological features were apparent.

#### ***H.6.11 Field 14***

This field is not depicted on the 6inch map. It is a roughly triangular field in the southwestern corner of Field 13, east of the N25 (Plate H.9). It is separated from Field 13 by a substantial drain. The field was poorly drained and some bog vegetation was growing in it, otherwise vegetation was high and visibility poor. Field 14 is in Youghal Mudlands and has been reclaimed. No archaeological features were apparent.

#### ***H.6.12 Field 15***

Field 15 is an irregular-shaped field of low pasture accessed from Field 16 to the east and adjoining farm yards to the south-west (Plate H.10). No archaeological features were apparent. A petrol station has been constructed to the west of the field along the N25 road. Field 15 is in Youghal Mudlands and has been reclaimed.

#### ***H.6.13 Field 16***

West of the grassy track Field 16 is in rough pasture (Plate H.11). It is poorly drained and some bog vegetation has developed. No archaeological features were apparent. It is divided from Field 15 by a stone wall. This is unusual as drains usually divide the fields in this area unless they represent townland boundaries. Adjoining this field to the south-west there are farm buildings and nearby, further south, there is a farmhouse. Field 16 is in Youghal Mudlands and has been reclaimed.

#### ***H.6.14 Field 17***

West of the grassy track, three fields have been amalgamated to form Field 17 (Plate H.12). A land drain which is depicted on the third edition 6 inch map separating the north-western portion of the field into a small triangular shaped field has been removed. In addition an east-west running field boundary which further divided Field 17 into two east west fields has been removed. This is now a large field of low pasture with some growth of bog vegetation. To the west there are farm buildings, a yard and a number of animal pens, all separated from Field 17 by a wall. The ground is very wet adjacent to these yards. Field 17 is in Youghal Mudlands and has been reclaimed. No archaeological features were revealed.

#### ***H.6.15 Field 18***

West of the grassy track, Field 18 was the only field in which there were animals at the time of the field inspection (Plate H.13). It is extremely wet and boggy, very dense bog vegetation is growing in this field and visibility is very poor. Field 18 is in Youghal Mudlands and has been reclaimed. No archaeological features were apparent.

#### ***H.6.16 Fields 19 and 20***

At the southern portion of the Target Site Area field boundaries have been modified by the construction of a new road into the northern part of Youghal town (Figure H.1). The old field layout is apparent from the 6 inch OS maps (Figure H.3). Fields 19 and 20 were cut by the road's construction (as well as Field 21, see below). On the northern side of the road, land within these fields appears to be unused. It is overgrown with rough bog vegetation. The road has been elevated several meters above the height of the fields. Visibility was poor and no archaeological features were apparent. Part of the land has been developed south of the road (Plate H.14) where several modern houses have been constructed in the southern parts of these fields in proximity to the gasworks site

(CO067-031---). Field 19 is in Youghal Mudlands which has been reclaimed, Field 20 is in the adjoining townland of Greencloyne which has not been reclaimed. No archaeological features were apparent but visibility was poor.

#### **H.6.17 Field 21**

Field 21, like Fields 19 and 20, was cut by the recently constructed road. It is in Youghal Mudlands and has been reclaimed. Field 21 is an irregularly-shaped field at the south-east of the Target Site Area. The field is bounded to the east by the large mound running along the eastern edge of the reclaimed land and the Blackwater estuary, to the west by the new road into the northern part of Youghal which is at a higher level, to the north by Field 19 and to the south by the quays which again are at a much higher level than Field 21. The field is low-lying, and appears to be unused. It is overgrown with rough bog vegetation and is quite wet and boggy. Visibility was poor and no archaeological features were apparent.

Within the Target Site Area there were no previously known archaeological sites. Field walking revealed no new archaeological sites. Given that most of this land was reclaimed during the nineteenth century the absence of archaeological sites is not unexpected. Two pieces of dressed stone were recovered from Field 5, however these appear to have been introduced to the area when the ground level was being raised.

## **H.8 Conclusions and Recommendations**

There are three possible locations for the treatment plant within the Target Site Area. Option 1 is located in Field 21 to the south-east of the Target Site Area. Option 2 is located in Field 2 and Option 3 in Fields 3 and 4. Archaeological features were not apparent in any of the three possible site locations. Option 1 is located close to the gasworks (CO067-031---), however it is outside the Zone of Archaeological Potential for

this site. Options 1, 2 and 3 are all within the reclaimed land of Youghal Mudlands. There are no known archaeological sites within the vicinity of any of the site options, except for the gasworks approximately 300m west of Option 1.

The development of Options 1, 2 or 3 do not appear to impact on any known archaeological sites. However given the nature of their proposed siting archaeological monitoring of ground works is recommended as coastal or estuarine archaeological features may be revealed during development. An intertidal survey of the area will be undertaken to ascertain if the outfall pipes will interfere with any previously unrecorded features.

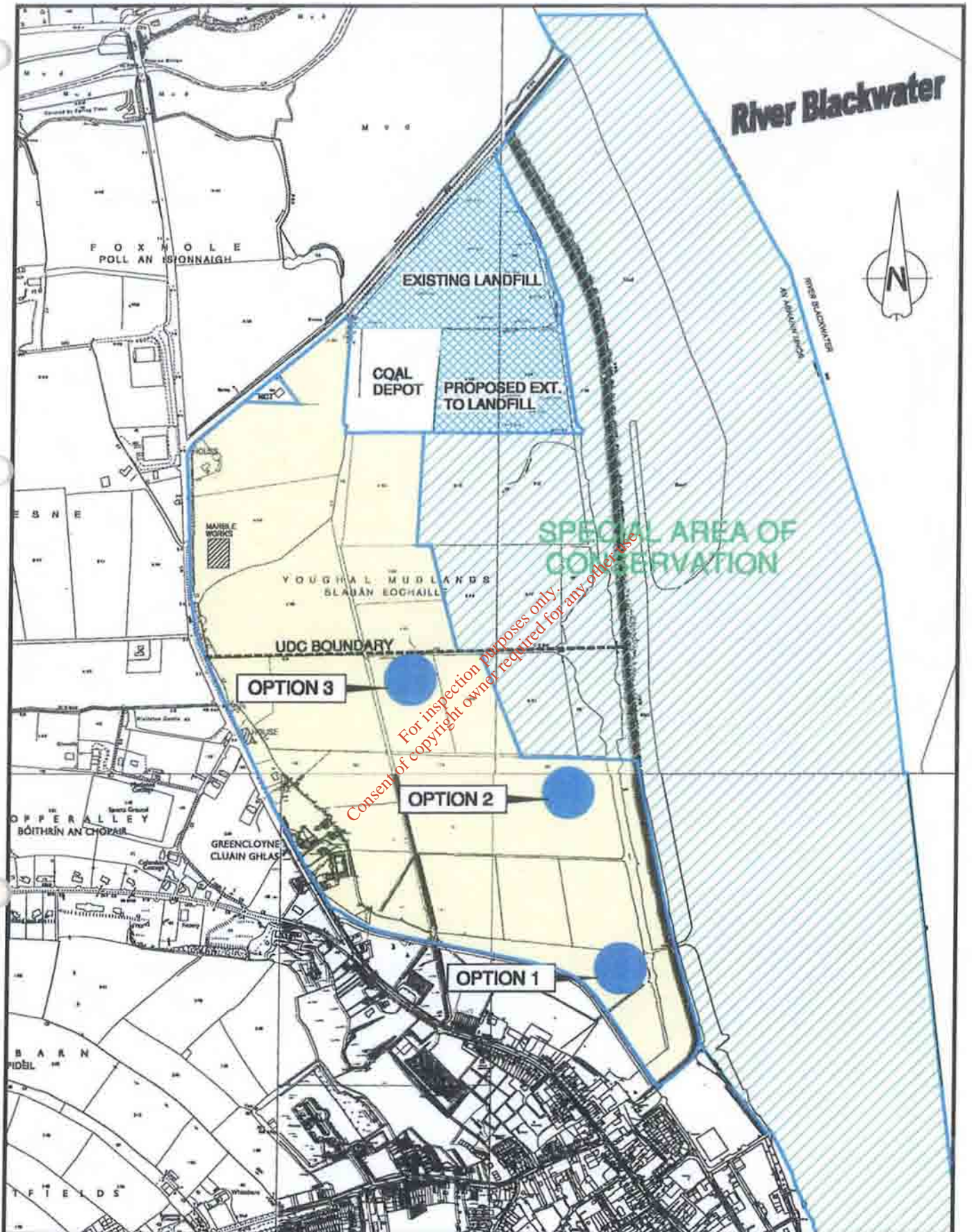
The archaeological implications for the development of a treatment plant within the Target Site Area are minimal. Archaeological monitoring will be required given the potential of features buried in the reclaimed mudflats. The archaeological implications of developing Options 1, 2 and 3 are broadly similar – none of the three options will impact on any known archaeological site. The archaeological implications for pipe laying to feed the treatment plant are more substantial. It is recommended that, where possible, pipes be laid along the foreshore. This will require an inter-tidal survey of the foreshore as well as archaeological monitoring of these works. It may be necessary to run some pipes through the town of Youghal. This should be kept to a minimum given the significant archaeological implications of undertaking large scale development within the historic town.

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Zajac, S. Cronin, J. and Kiely, J. 1995. *Urban Archaeological Survey of County Cork*.  
Unpublished report.

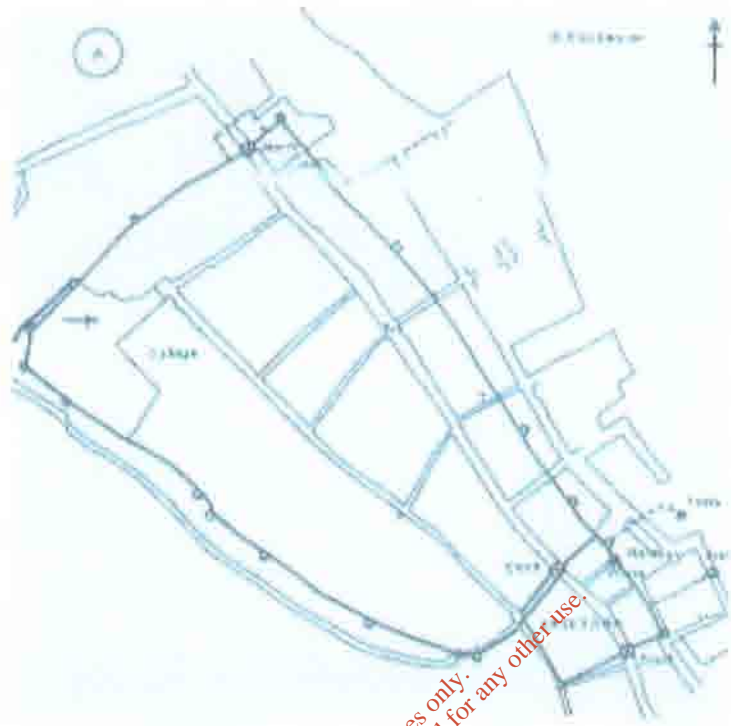
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 Target Site Area

TARGET SITE AREA FIGURE H.1





**Fig. H.2:** The medieval walled town, after Thomas (1992)

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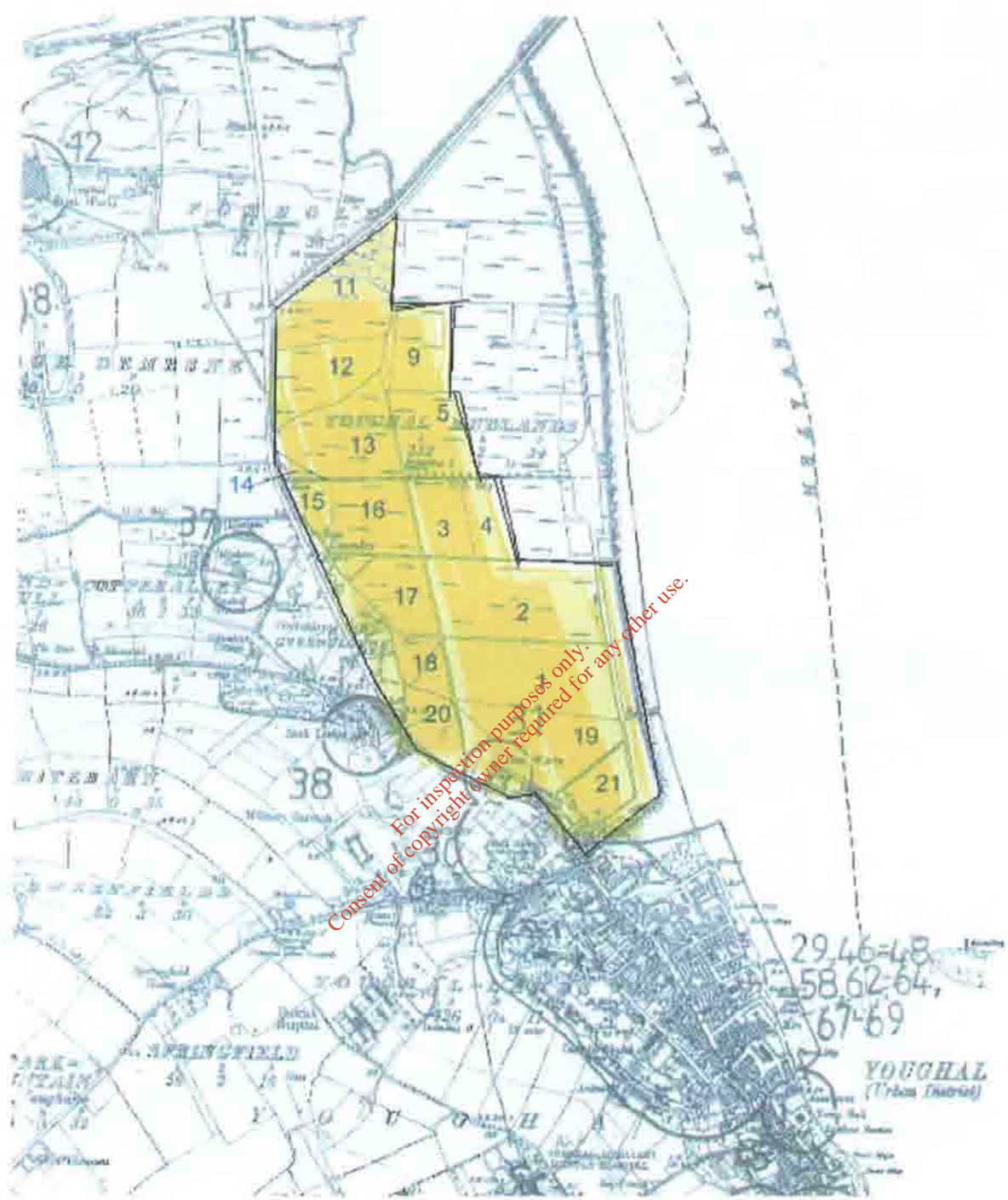
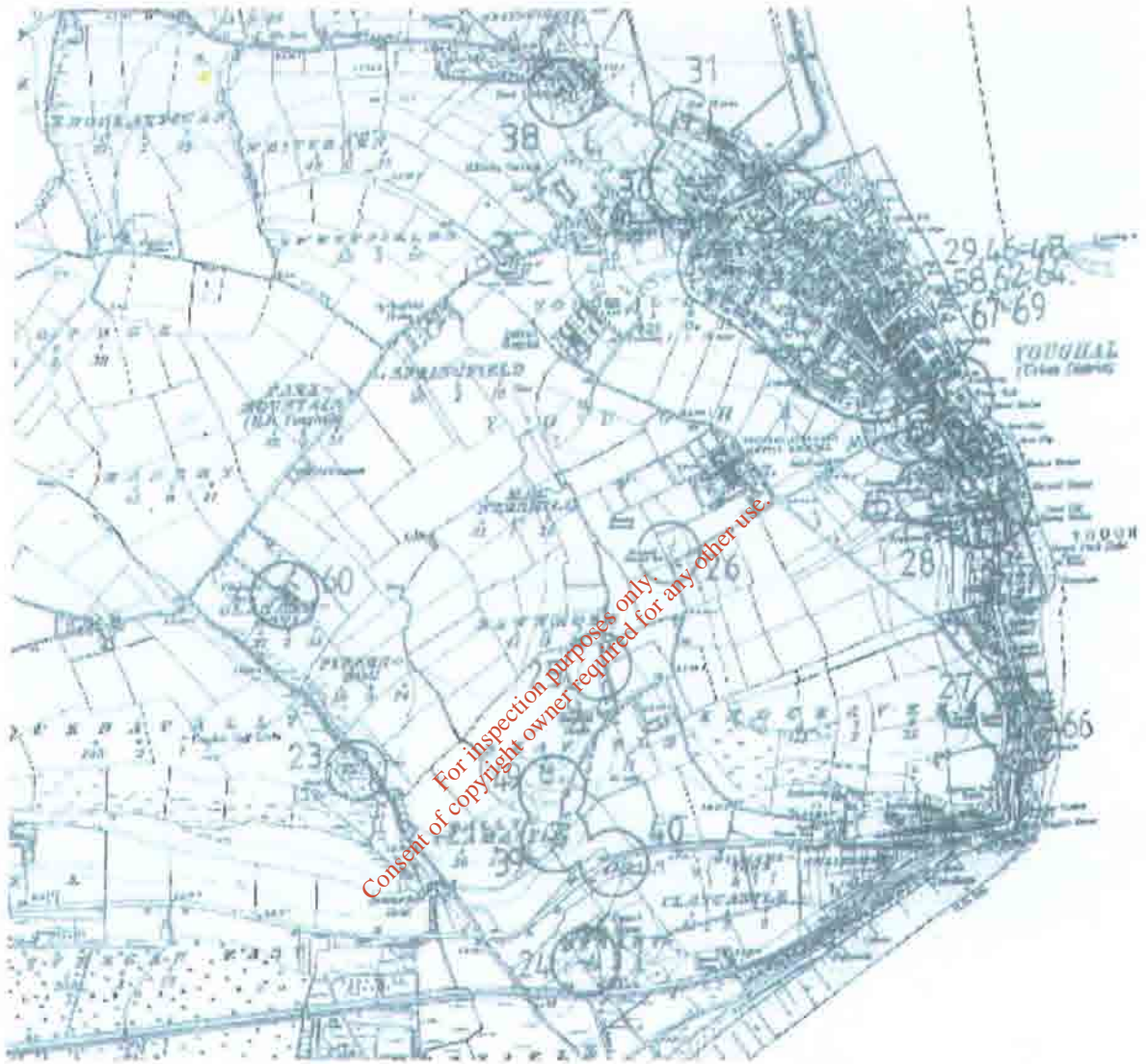
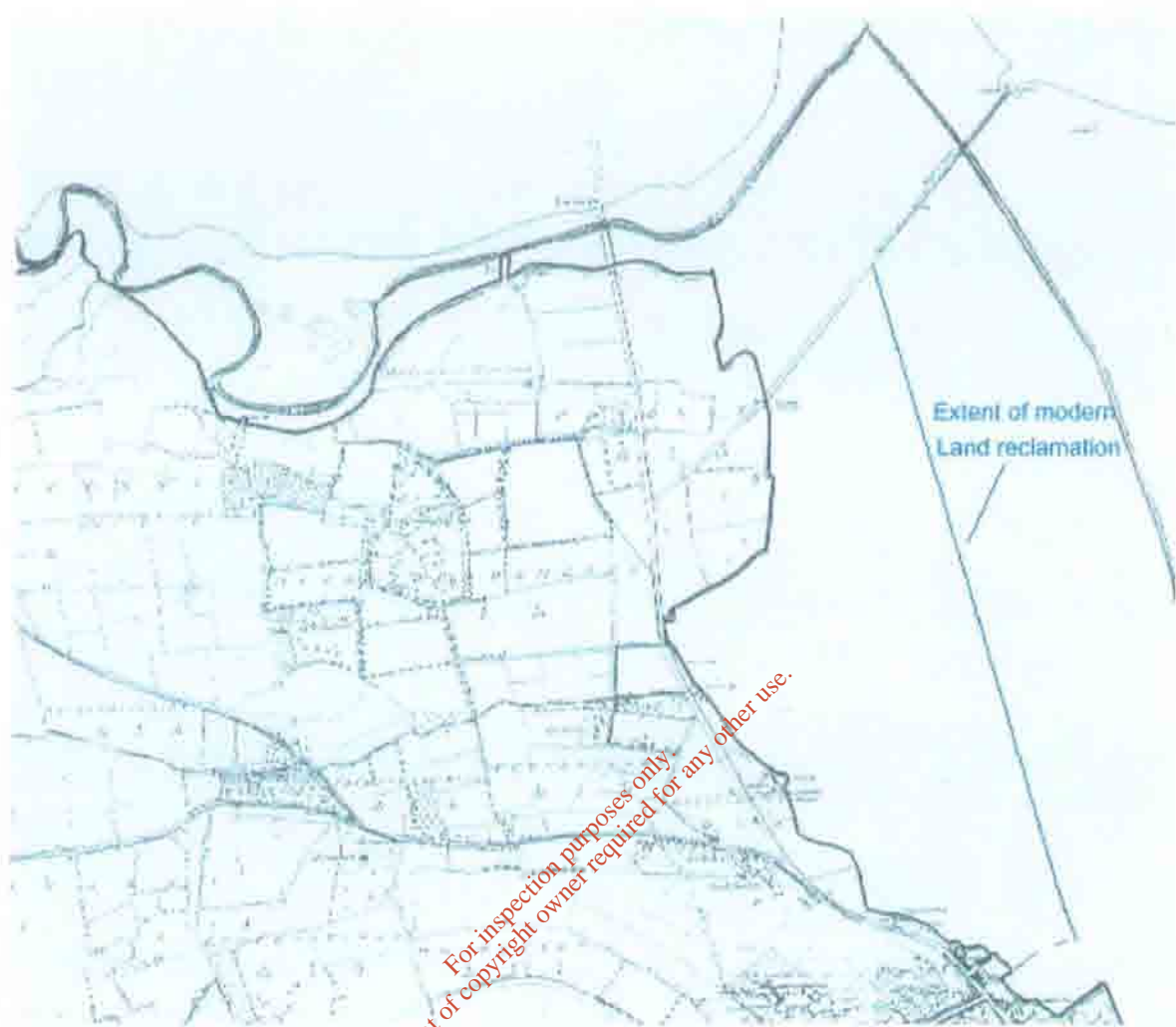


Fig. H.3: RMP map extract (CO067); showing site location and field numbers



**Fig. H.4:** RMP map extract (CO067); showing archeological sites in and around Youghal



**Fig. H.5:** 6" OS 1842 map, reduced. Area north of Youghal prior to reclamation

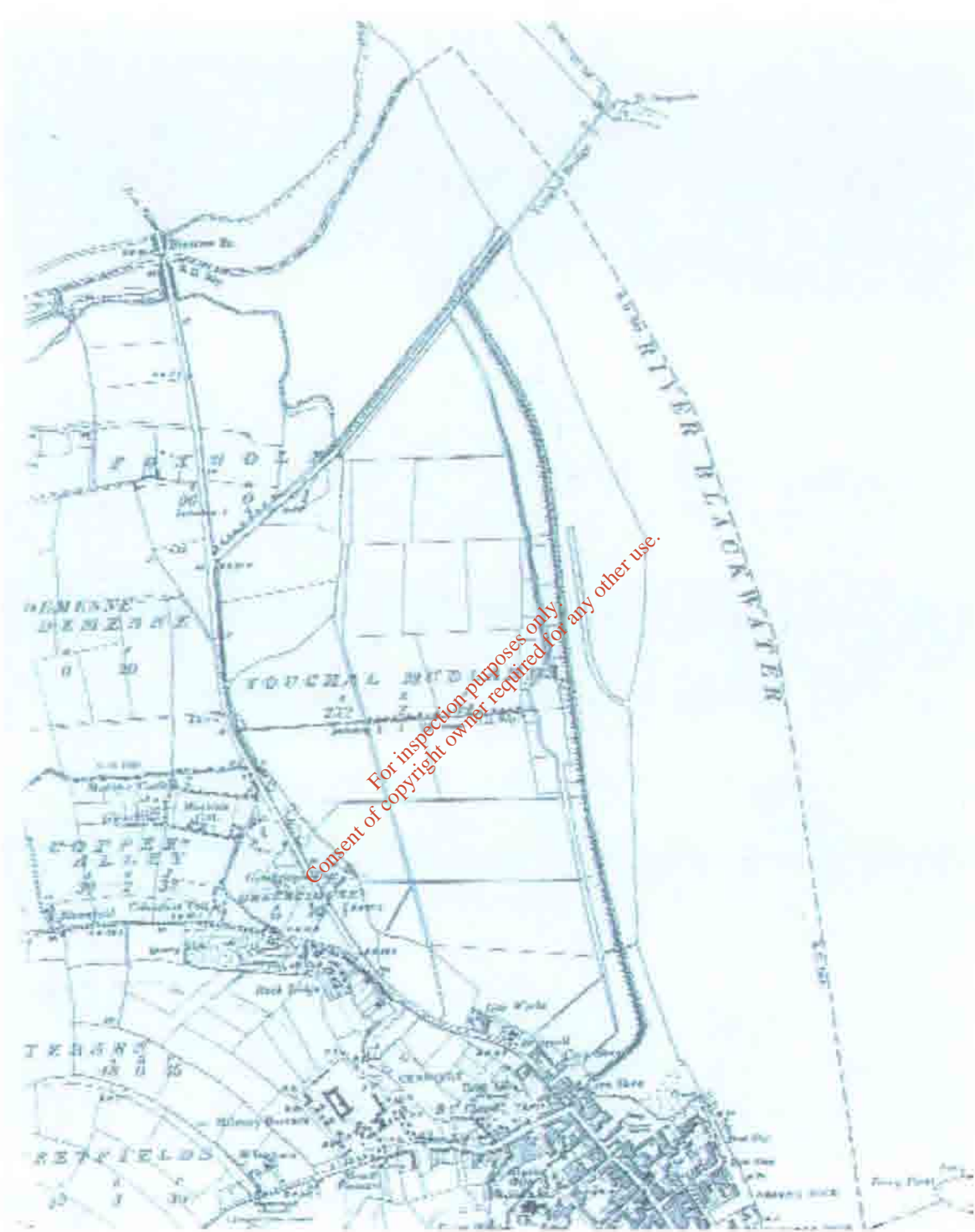


Fig. H.6: 6" map 1903, reduced. Youghal Mudlands following reclamation



**Plate H.1:** Field 1, looking northwest



**Plate H.2:** Field 2, looking northwest. Wire fence shows modern division of field



**Plate H.3:** Field 3, looking northeast



**Plate H.4:** Field 5, looking northeast

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**Plate H.5:** Field 9, looking northeast



**Plate H.6:** Field 11, looking east

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**Plate H.7:** Field 12, looking southeast.



**Plate H.8:** Field 13, looking southeast.

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**Plate H.9:** Field 14, looking southeast.



**Plate H.10:** Field 15, looking southeast.

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**Plate H.11:** Field 16, looking east



**Plate H.12:** Field 17, looking northeast

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**Plate H.13:** Field 18, looking east



**Plate H.14:** Field 19, looking east

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**APPENDIX I**

**Traffic Assessment**

*Atkins McCarthy, Cork Office.*

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# Youghal Wastewater Treatment Plant

## TRAFFIC IMPACT ASSESSMENT

|                |                   |   |      |
|----------------|-------------------|---|------|
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## 1.0 INTRODUCTION

1.1 This Traffic Impact Assessment is part of the Environmental Impact Statement prepared by Atkins McCarthy for Youghal Wastewater Treatment Plant.

## 2.0 DESCRIPTION OF DEVELOPMENT

2.1 The site area for the development is located in the Youghal Mudlands to the west of the Munster Blackwater Estuary. The N25 National Primary Route forms a border to the site to the west and south. The entrance road to the landfill site located to the north-east of the target site area forms the north-western border. A sea wall forms approximately 0.5 km of the eastern boundary to the area. The remainder of the eastern border to the site is formed by the boundary of a Special Area of Conservation that lies to the east. The site location plan is shown in Figure 13.1.

2.2 There are three options being considered with respect to the ultimate location of the treatment plant within the target site area. The options are illustrated in Figure 4.1 of the main report.

2.3 The Wastewater Treatment Plant itself will be approximately 2 hectares in size.

2.4 It is proposed to commence construction of the proposed development during 2003 and the expected construction period is 12 to 18 months.



### 3.0 EXISTING ROAD NETWORK

3.1 The N25 forms a border to the site to the west and south over approximately 2 km of National Primary Road (Figure I.1). The N25 is the National Primary Route that links Cork to Waterford and Rosslare. This route takes traffic through the old narrow streets of Youghal, which operates on a way system to improve traffic flow. To implement this one way system, a new road was constructed adjacent to the Mudlands in the late 1980's. This road forms the northern perimeter to the town and connects the southbound N25 route at Greencloyne Roundabout, located immediately north of the town, with the eastern streets at Youghal Shipping Yard adjacent to the estuary.

3.2 West of the development Study area, the N25 is located within the 40 m.p.h Youghal urban speed limit zone and is classified as an urban, national undivided road with a typical carriageway width of 7.5m. At this location, there are no hard shoulders. The 30 m.p.h. urban speed limit zone starts north of the roundabout at Greencloyne.

3.3 From the roundabout at Greencloyne, the N25 continues one-way southwards towards the town as far as the intersection of Strand Street, Friar Street and South Abbey. From this location, two-way flow returns. The one-way system described above enables southbound traffic to avoid Youghal Main Street to the west where northbound traffic is directed. It is important to note that although traffic wishing to head north from the Youghal Shipping Yard area is prohibited from entering the section of the N25 described above, traffic is permitted to turn right out of the Mudlands, where the future WWTW will be located, and onto this road.

#### 4.0 EXISTING (2001) TRAFFIC FLOWS

4.1 Traffic Flow Data for the relevant sections of the N25 adjacent to Youghal was obtained from the NRA publication RT580 – National Roads and Traffic Flow 1999.

4.2 The 1999 Annual Average Daily Traffic (A.A.D.T.) volumes on the 30 m.p.h speed limit zone on the N25 north of Youghal were of the order of 9,500 vehicles. The proportion of heavy commercial vehicles (h.c.v.'s) was 13%, which equates to approximately 1250 h.c.v.'s. On the one-way section heading south on the N25, the 1999 A.A.D.T. volumes were of the order of 7500 vehicles and the proportion of h.c.v.'s was 8% which equates to approximately 600 h.c.v.'s. On the two-way section through Youghal Town, the 1999 A.A.D.T. volumes were of the order of 11,000 vehicles and the proportion of h.c.v.'s was 9% resulting in approximately 990 h.c.v.'s.

4.3 The National Roads Authority (N.R.A.) in their National Road Needs Study, proposed that light vehicle traffic on national roads would increase by 4% per annum from 2000 to 2005 and by 2% per annum thereafter. Heavy commercial traffic was expected to increase at an annual average rate of 3%. In accordance with these forecasts, the 1999 traffic volumes on the N25 were factored to 2001 levels using these assumed future traffic growth forecast rates.

4.3 Accordingly, the derived 2001 A.A.D.T. volumes on the N25 are shown in Table 1.

**Table 1**  
**Derived 2001 Traffic Volumes (A.A.D.T & h.c.v.'s)**

| <i>Location on N25</i>                | <i>2001 A.A.D.T. (vehs)</i> | <i>h.c.v.'s</i> |
|---------------------------------------|-----------------------------|-----------------|
| 30 m.p.h. SL north of Youghal (2-way) | 10,250                      | 1,325           |
| One-way section southbound            | 8,105                       | 640             |
| 2-way section Youghal                 | 11,875                      | 1,050           |

## 5.0 PROPOSED DEVELOPMENT ACCESS

5.1 There are three site options being considered with regard to site selection and four options for development access to be examined.

5.2 As shown in Figure I.1, the access road to the WWTW in each of Options 1 – 3 would link directly with the section of the N25 between Greencloyne Roundabout and Youghal Shipping Yard.

5.3 In each of the options, the T-junction formed at the WWTW entrance would be required to achieve acceptable sight distances in accordance with the DMRB standard, TD42/95. The new entrance arrangement would have to incorporate road markings and signage as required by Cork County Council.

5.4 Consideration was given to providing access to site option 3 from the N25 to the west of the site which is a shorter route. However, sight distances were inadequate at this location by comparison with the other locations. This access was also less favourable in terms of its impacts on local residences both during construction and operational phases.

## 6.0 TRAFFIC GENERATION AND DISTRIBUTION

6.1 The employees proposed hours of operation of the plant are 08:00 – 17:30, Monday – Friday. Accordingly, traffic generated by the treatment plant employees will occur before the morning peak hour and during the evening peak hour. It is anticipated that traffic generated by the treatment plant employees will amount to 5 car movements in and 5 car movements out of the site per day.

6.2 When operational, sludge will be transported off-site between the hours of 08:00 and 17:30, Monday to Friday. It is estimated that approximately 2 tons of sludge will be produced per day, which equates to approximately 15 tons per week. It is expected that sludge will be collected in 2 X 17-ton bins and each bin will be emptied in turn when it is full. Accordingly, trip generation due to the transportation of sludge off-site will be of the order of 5 trips in and 5 trips out of the treatment plant per week. This equates to 1 trip in and 1 trip out of the site per day, Monday to Friday.

6.3 The sludge will be transported from Youghal Wastewater Treatment Plant to Middleton for treatment.

6.4 It is expected that chemicals will be delivered to the treatment plant once a week during normal operating hours.

6.5 The predicted two-way traffic volumes generated by the treatment plant during the daily 9.5-hour operation period are shown in Table 2. The trips generated to and from the plant due to the delivery of chemicals once weekly are included in Table 2 in order to give the maximum number of trips that may be generated in a day.

**Table 2**  
**Predicted 2-Way Traffic Volumes**

| <i>Trip Generation</i> | <i>9.5-Hour Operation Period<br/>(light vehs)</i> | <i>9.5-Hour Operation Period<br/>(h.c.v.'s)</i> |
|------------------------|---|---|
| Employee Trips         | 5   | 0   |
| Sludge Transportation  | 0   | 1   |
| Chemical Deliveries    | 0   | 1   |
| <b>Total</b>           | <b>5</b>  | <b>2</b>  |

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## **7.0 TRAFFIC IMPACT**

**7.1** As shown in Table 2, it is expected that the Wastewater Treatment Plant will generate a maximum two-way daily volume of 7 vehicles.

**7.2** This figure represents less than 1% of the predicted 2005 (proposed opening year) A.A.D.T. volumes on the N25 adjacent to the site. The predicted 2005 2-way traffic volumes take into account the expected 65% reduction in traffic on this section of the N25 due to the proposed opening of the Youghal by-pass in 2003.

**7.3** The proposed Wastewater Treatment Works will not have any significant adverse traffic impact on the surrounding road network when operational.

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## 8.0 CONSTRUCTION TRAFFIC

8.1 The expected construction period is 12 to 18 months. Construction is proposed to commence in 2003.

8.2 Peak construction employment on site is expected to be of the order of 60 persons. Assuming that all employees travel to and from work by vehicle at an average occupancy of 1.3 persons per vehicle, it is expected that the total two-way traffic flows generated by construction employees during the morning and evening peak hour periods will be of the order of 46 vehicles.

8.3 Based on experience from similar developments in the Munster area and assumptions made for the proposed plant in Youghal, peak construction deliveries are expected to be of the order of 100 heavy commercial vehicles in and out of the site per day.

8.4 The predicted two-way, daily traffic volumes generated during the peak construction period are shown in Table 3.

**Table 3**  
**Predicted 2-Way Daily Construction Traffic Volumes**

| <i>Trip Generation</i>  | <i>Light vehs</i> | <i>h.c.v.'s</i> |
|-------------------------|-------------------|-----------------|
| Employee Trips          | 46                | 0               |
| Construction Deliveries | 0                 | 100             |
| <b>Total</b>            | <b>46</b>         | <b>100</b>      |

8.5 As shown in Table 3, it is expected that during the peak construction period, a two-way daily volume of 146 vehicles will be generated. This equates to a maximum two-way daily volume of 12 vehicles Monday to Friday assuming normal working hours. The two-way daily volume of 146 vehicles represents approximately 5% of the predicted 2004 A.A.D.T. volumes on the one-way section of the N25 adjacent to the site. It is assumed that the peak construction period will occur in 2004 and background traffic volumes take into account the

expected 65% reduction in traffic due to the proposed opening of the Youghal by-pass in 2003.

**8.6** It is important to note that the peak construction period accounts for a mere portion of the entire construction period and that traffic figures quoted above are the maximum two-way volumes anticipated during this time. Also, although the construction impacts are the more onerous in the scheme they will not be significant as good access is available from the road network particularly with the opening of the Youghal Bypass subject to the mitigation measures outlined in Section 9 of this report.

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## 9.0 MITIGATION MEASURES

9.1 Hard-stand parking areas should be provided within the site for all construction parking.

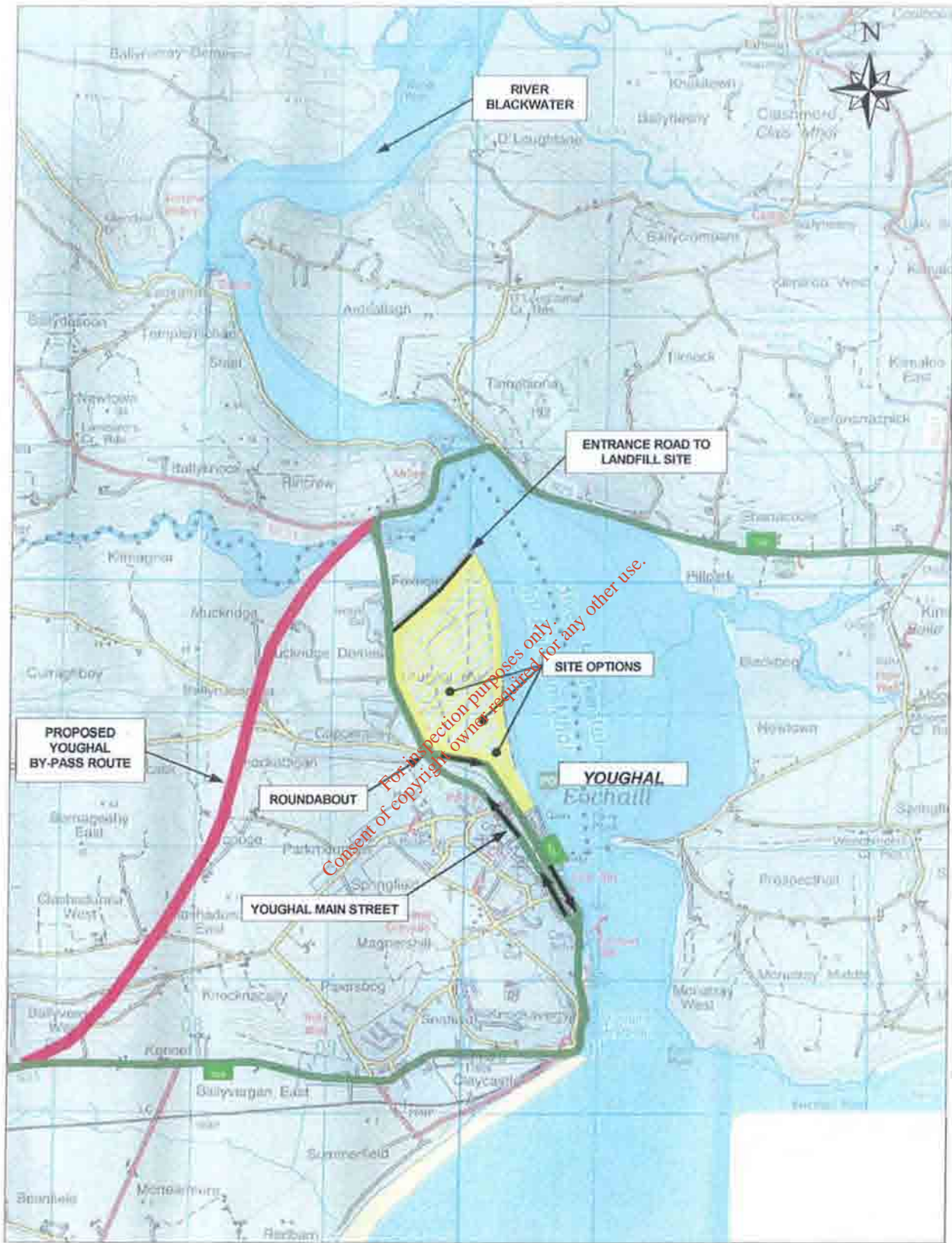
9.2 The routing of construction vehicles will be agreed in the contract documents. This will include the restriction of construction traffic from travelling through the town with traffic directed to use the bypass, which will open in 2003.

9.3 Traffic control related to the construction period will be in accordance with the NRA and Cork County Council.


9.4 All necessary construction warning signs and permanent vehicle wash facilities will be provided prior to the commencement of construction.

9.5 The new entrance arrangement will have to incorporate road markings and signage as required by Cork County Council.

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 Proposed Study Area for Wastewater Treatment Works

 One Way Traffic Flow



**SITE LOCATION IN CONTEXT OF SURROUNDING ROAD NETWORK**

**FIGURE I.1**

**APPENDIX J**

**Odour Monitoring Assessment**

*Bord na Mona, Main Street, Newbridge, Co. Kildare.*

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**APPENDIX J1. REPORT FOR ODOUR MONITORING ON 4<sup>TH</sup>  
JULY 2001**

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*A BASELINE ODOUR MONITORING SURVEY AT  
YOUGHAL, Co. CORK ON BEHALF OF ATKINS MC  
CARTHY CONSULTING ENGINEERS, VILLA FRANCA,  
DOUGLAS ROAD, CORK*

REPORT NO:

T210

ATTENTION:

Ms. Louise Collier

Atkins McCarthy Consulting Engineers

Villa Franca

Douglas Road

Cork

PREPARED BY:

Séamus Cunningham

Environmental Consultant

REVIEWED BY:

Lisa Blyth

Operations Manager

DATE:

11<sup>th</sup> July 2001

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**EXECUTIVE SUMMARY**

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to conduct a study to determine the existing baseline odour levels in the vicinity of a proposed Wastewater Treatment Plant (WWTP) at Youghal. An Environmental Consultant from Bord na Móna Environmental Limited visited the target site area on the 4<sup>th</sup> of July 2001 to carry out the odour monitoring survey.

The baseline levels recorded during this survey range from 67 – 140 ou/m<sup>3</sup>, approximately 6 times higher than typical rural open-air background concentrations. In general, the results obtained indicate that as one travels further downwind (south) of the landfill the odour concentration decreases (140ou/m<sup>3</sup> -71ou/m<sup>3</sup>). It is considered that on the day of the monitoring that both the landfill and the agricultural odour sensed at all sampling locations were the most significant contributors to the elevated levels.

In summary, it may be concluded that the general background odour levels in this area range from 67 – 140 ou/m<sup>3</sup>.

The report is certified as accurate and representative of the sampling and associated analysis carried out.

Respectively Submitted

**Mr. Séamus Cunningham**  
Environmental Consultant

**Ms. Lisa Blyth**  
Operations Manager

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## 1.0 INTRODUCTION

Atkins McCarthy, Consulting Engineers on behalf of Youghal Urban District Council are presently undertaking an Environmental Impact Statement for the construction of a new sewage treatment works on a green field site in Youghal, Co. Cork . As part of this Environmental Impact Statement they are required to ascertain the baseline odour levels at the proposed locations and in the surrounding environs.

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to determine these baseline odour levels. A Bord na Móna Environmental Consultant subsequently visited the site on the 4<sup>th</sup> of July 2001 to conduct the monitoring. The odour samples were returned to the laboratory for subsequent analysis.

This report presents details of the monitoring programme detailing sampling and analytical methodologies together with results obtained. In addition a broad interpretation of the results obtained is included.

## 2.0 METHODOLOGY

### 2.1 Sampling Locations

Table 2.1 describes the odour sampling locations which are marked on Drawing 'Site Selection Drawings – Options 1-4' in Appendix 1.

| <b>Sampling Location/Source</b> | <b>Justification</b>  |
|---------------------------------|---|
| Upwind                          | To ascertain the baseline odour level upwind of the proposed WWTP locations   |
| Option 3                        | To ascertain the baseline odour level at Option 1                             |
| Option 3                        | To ascertain the baseline odour level at Option 2                             |
| Option 3                        | To ascertain the baseline odour level at Option 3                             |
| Downwind                        | To ascertain the baseline odour level Downwind of the proposed WWTP locations |



## 2.2 Odour Sampling and Analysis

For each location a sample of the ambient air of approximately 30 - 40 litres was collected via Teflon tubing into a nalophane gas sampling bag by means of the "lung principle" method. Using this method the sample bag is housed in a sealed carbuoy, which is evacuated using a small air pump. The volume of air removed from the carbuoy is replaced by sample gas entering the bag, thus avoiding contamination of sample by pumps or meters. Sampling was carried out in accordance with German Standard Method VDI 3881 (1987). Each sample was collected at a rate of approximately 4litres/min for 15mins.

The samples were analysed by Dynamic Olfactometry. The instrument used was an Olfactomat-e Olfactometer (Project Research Amsterdam) and the analytical procedures were in accordance with the CEN Standard TC264 (1999) using a trained panel of 8 assessors. The odour concentration of the sample is expressed in odour units per cubic metre of gas (ou/m<sup>3</sup>). These values, sometimes referred to as "dilutions to threshold" are equivalent to the number of times the sample gas required dilution with odour free air to reach the panel's odour threshold (i.e. the concentration at which there is a 50% probability of the panelists detecting the odour).

## 2.3 Control Chain Of Custody

As part of the Quality System in place in Bord na Móna, Environmental Limited; measures are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf.

**BORD NA MÓNA**   
BORD NA MÓNA ENVIRONMENTAL LIMITED

**CONTROLLED CHAIN OF CUSTODY**

**SITE**

Sampling and packaging of all samples were carried out by Bord na Móna Technical Team: S. Cunningham

**TRANSPORT**

Transport Document Form  
Transport to laboratory by Bord na Móna Technical Team.

**LABORATORY**

Sample Reception Form  
Receiving of samples at Bord na Móna Environmental Laboratory complex by:  
Ms. M. McFadden, Laboratory Manager

(Secure laboratory complex access to authorised personnel only)

→

→

↓

Storage of all samples for 1 month period after report issue.

↓

Supervised Disposal

## 2.4 Quality Control

The Environmental Limited Laboratory complex has been awarded ILAB accreditation by the ILAB secretariat. A stringent six-point quality control approach is at present implemented in the laboratories.

- (i) Controlled chain of custody.
- (ii) Operator competence - all analysts must be suitably qualified to carry out the required analysis.
- (iii) Certified Reference Materials (CRM). The accuracy of a series of determinations is checked against known standards.
- (iv) Duplicate - 10% duplication is normal.
- (v) Quality Control Charts.
- (vi) Inter Laboratory Testing - The Environmental Limited Laboratories are members of the WASP Interproficiency Testing Scheme and the W.R.C. Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the current EPA Register of Quality Approved Testing Laboratories.

### 3.0 RESULTS

The results of the investigation are detailed in Tables 3.1 and 3.2 below.

**TABLE 3.1: ON-SITE METEOROLOGICAL CONDITIONS**

Warm with north-easterly breeze

**TABLE 3.2: RESULTS OF ODOUR ANALYSIS FROM TREATMENT PLANT**

| Location | Concentration<br>(ou/m <sup>3</sup> ) |
|----------|---------------------------------------|
| Upwind   | 140                                   |
| Option 3 | 92                                    |
| Option 2 | 87                                    |
| Option 1 | 67                                    |
| Downwind | 71                                    |

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#### 4.0 COMMENT

An odour is defined as a sensation resulting from the reception of a stimulus by the olfactory sensory system. The way the human response to an odour is evaluated depends on the particular sensory property that is being measured, including the intensity, detectability, character, and hedonic tone (acceptability) of the odour. The combined effect of these properties is related to the annoyance that may be caused by the odour. Odorous air pollutants are often judged important, primarily for their nuisance value and the number of complaints they generate.

By definition  $1\text{ou}/\text{m}^3$  is the detection threshold of 50% of a panel of trained observers working in an odour free environment. The recognition threshold is about 5 times this concentration i.e.  $5\text{ou}/\text{m}^3$ . Moreover, it is generally accepted that odour concentrations between 5 and  $10\text{ou}/\text{m}^3$  above the baseline concentration give rise to a faint odour and that only concentrations greater than  $10\text{ou}/\text{m}^3$  constitute a distinct odour.

The results of the odour assessment undertaken at the proposed locations of the Youghal wastewater treatment plant (WWTP), south of the Youghal Landfill site are detailed in Tables 3.1 and 3.2.

Prior to undertaking the sampling, a short site inspection was conducted to subjectively ascertain the existing predominant sources of odour in the vicinity of the proposed wastewater treatment plant locations. In doing so, it was noted that the landfill, located north of both Youghal town and the proposed WWTP locations was a significant source of odour. The only other noteworthy odour, was the general background agricultural odour that one could smell to varying degrees in the target site area (see map in appendix 1). Following this inspection, the sampling locations were chosen, bearing in mind the north/north-easterly wind direction. They are detailed in Table 2.1 and indicated on the map in Appendix I.

Samples were taken at each proposed WWTP location to ascertain the baseline levels at each proposed location. Following, a baseline upwind and downwind sample was taken. Since the wind was north/north easterly in direction the upwind sample was taken within the Youghal Mudlands area just south of the proposed extension to the landfill. The downwind sample was taken approximately 40m west of the proposed WWTP option 1 location, only 150m

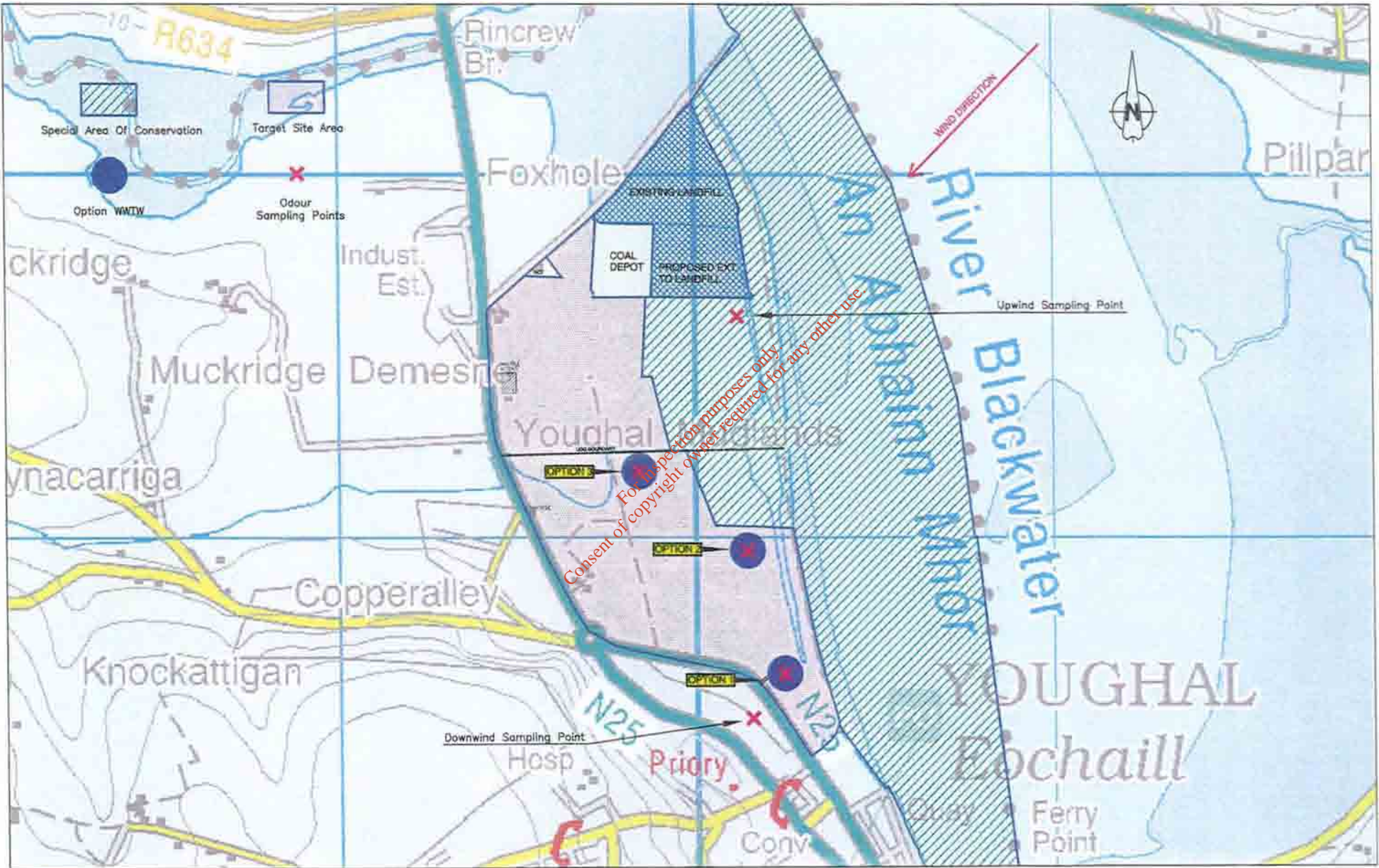
from the edge of the town. It is therefore a good indication of the baseline level found in the town.

In general, it may be stated that normal rural open-air background concentrations typically range from 10 – 25 ou/m<sup>3</sup>. These may occur as a result of natural odour sources (woods, pasture, surface waters etc.) and are not usually considered as being a nuisance.

The baseline levels recorded during this survey range from 67 – 140 ou/m<sup>3</sup>, approximately 6 times higher than typical rural open-air background concentrations. In general, the results obtained indicate that as one travels further downwind (south) of the landfill the odour concentration decreases (140ou/m<sup>3</sup> - 71ou/m<sup>3</sup>). It is considered that on the day of the monitoring that both the landfill and the agricultural odour sensed at all sampling locations were the most significant contributors to the elevated levels.

In summary, it may be concluded that on the day of monitoring, the general background odour levels in this area range from 67 – 140 ou/m<sup>3</sup>.

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**APPENDIX J2. REPORT FOR ODOUR MONITORING ON 15<sup>TH</sup>  
AUGUST 2001**

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*A BASELINE ODOUR MONITORING SURVEY AT  
YOUGHAL, CO. CORK ON BEHALF OF ATKINS MC  
CARTHY CONSULTING ENGINEERS, VILLA FRANCA,  
DOUGLAS ROAD, CORK*

REPORT NO:

T261

ATTENTION:

Ms. Louise Collier

Atkins McCarthy Consulting Engineers

Villa Franca

Douglas Road

Cork

PREPARED BY:

Sean Creedon

Environmental Consultant

REVIEWED BY:

John Conway

Air Quality Section Head

DATE:

28<sup>th</sup> August 2001

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**EXECUTIVE SUMMARY**

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to conduct a study to determine the existing baseline odour levels in the vicinity of a proposed Wastewater Treatment Plant (WWTP) at Youghal. Following the results of the sampling and analysis carried out on the 4<sup>th</sup> of July, it was felt that further investigation was necessary. As a result an Environmental Consultant from Bord Na Móna Environmental Limited visited the target site area on the 15<sup>th</sup> of August to carry out a further odour monitoring survey.

The baseline levels recorded during this survey range from 9 - 62 ou/m<sup>3</sup>. Most of the levels recorded fall into the category of faint odour (5 – 10 ou/m<sup>3</sup>) apart from that measured at house one location (see Appendix 1). A concentration of 62 ou/m<sup>3</sup> was recorded at this location and may be attributed to a slight metallic odour emanating from the shed at the back of this location. It is not possible to comment on the odour levels at house one and house two in comparison to the previous report as these are new sampling locations. Comparing the results of the other three locations to those presented in the previous report, a marked decrease in odour levels is evident. This can be attributed to the strong prevailing wind on the day of sampling which prevented any possible odour influence from the adjacent landfill or mudflats.

In summary, it may be concluded that the general background odour levels in this area range from 9 - 62 ou/m<sup>3</sup> on the day of sampling.

The report is certified as accurate and representative of the sampling and associated analysis carried out.

Respectively Submitted

**Mr. Sean Creedon**  
Environmental Consultant

**Mr John Conway**  
Air Quality Section Head

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| 3.0 | RESULTS                     |
| 4.0 | COMMENT                     |

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## 1.0 INTRODUCTION

Atkins McCarthy, Consulting Engineers on behalf of Youghal Urban District Council are presently undertaking an Environmental Impact Statement for the construction of a new sewage treatment works on a green field site in Youghal, Co. Cork . As part of this Environmental Impact Statement they are required to ascertain the baseline odour levels at the proposed locations and in the surrounding environs. There are three proposed options (one, two and three) for the siting of the treatment plant and they are indicated on drawing 1 in Appendix 1.

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to determine these baseline odour levels. A Bord na Móna Environmental Consultant subsequently visited the site on the 15<sup>th</sup> of August 2001 to conduct the monitoring as part of an ongoing effort to determine the baseline odour values. The odour samples were returned to the laboratory for subsequent analysis.

This report presents details of the monitoring programme including sampling and analytical methodologies together with results obtained. In addition a broad interpretation of the results obtained is included.

## 2.0 METHODOLOGY

### 2.1 Sampling Locations

Table 2.1 describes the odour sampling locations which are marked on Drawing 1 in Appendix 1.

| <b>Sampling Location/Source</b> | <b>Justification</b>   |
|---------------------------------|--|
| Downwind                        | To ascertain the baseline odour level Downwind of the proposed WWTP location |
| House one                       | To ascertain the baseline odour level at a sensitive receptor                |
| House two                       | To ascertain the baseline odour level at the nearest sensitive receptor      |
| Option 3                        | To ascertain the baseline odour level at Option 3                            |
| Upwind                          | To ascertain the baseline odour level Upwind of the proposed WWTP location.  |

### 2.2 Odour Sampling and Analysis

For each location a sample of the ambient air of approximately 30 - 40 litres was collected via Teflon tubing into a nalophane gas sampling bag by means of the "lung principle" method. Using this method the sample bag is housed in a sealed carbuoy, which is evacuated using a small air pump. The volume of air removed from the carbuoy is replaced by sample gas entering the bag, thus avoiding contamination of sample by pumps or meters. Sampling was carried out in accordance with German Standard Method VDI 3881 (1987). Each sample was collected at a rate of approximately 4 litres/min for 15mins.

The samples were analysed by Dynamic Olfactometry. The instrument used was an Olfactomat-e Olfactometer (Project Research Amsterdam) and the analytical procedures were in accordance with the CEN Standard TC264 (1999) using a trained panel of 8 assessors. The odour concentration of the sample is expressed in odour units per cubic metre of gas (ou/m<sup>3</sup>). These values, sometimes referred to as "dilutions to threshold" are equivalent to the number of times the sample gas required dilution with odour free air to reach the panels odour threshold (i.e. the concentration at which there is a 50% probability of the panelists detecting the odour).

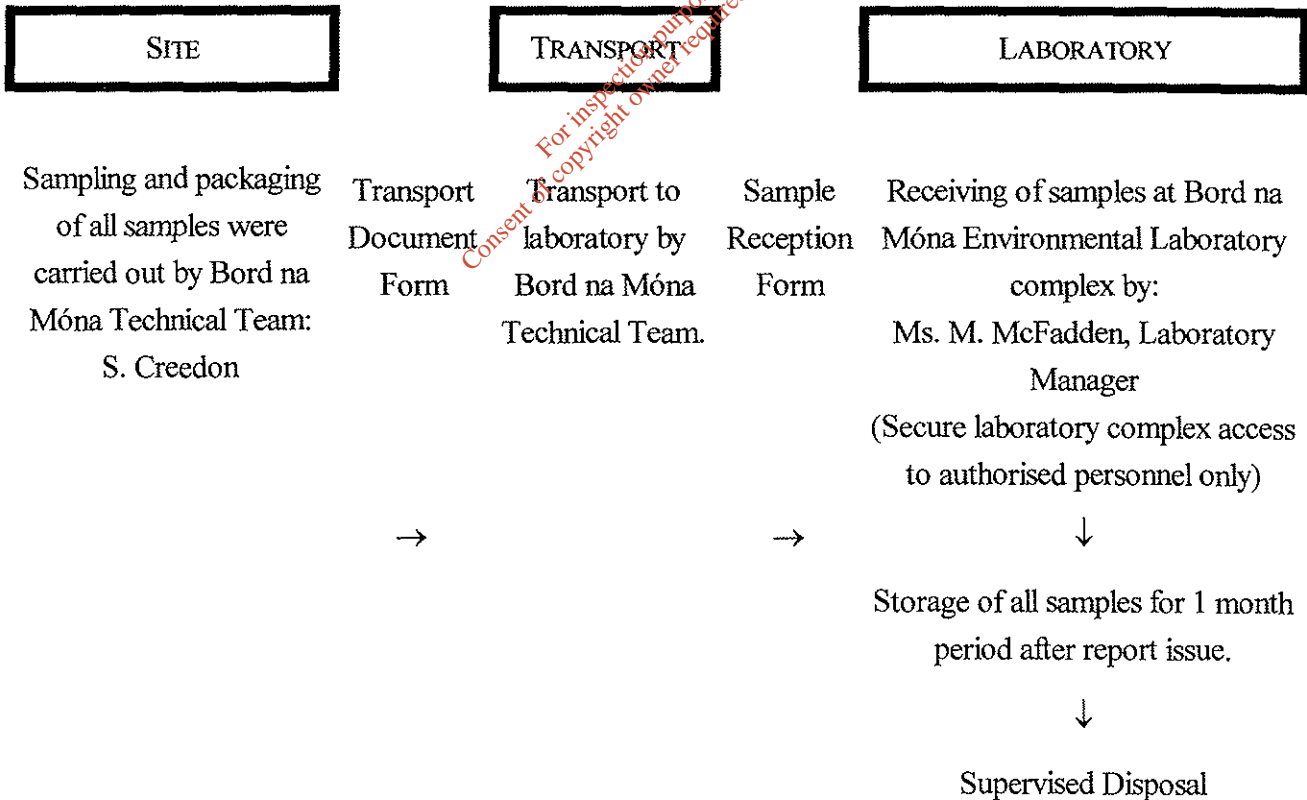
### 2.3 Control Chain Of Custody

As part of the Quality System in place in Bord na Móna, Environmental Limited; measures are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf.

# BORD NA MÓNA

BORD NA MÓNA ENVIRONMENTAL LIMITED

## CONTROLLED CHAIN OF CUSTODY



## 2.4 Quality Control

The Environmental Limited Laboratory complex has been awarded ILAB accreditation by the ILAB secretariat. A stringent six-point quality control approach is at present implemented in the laboratories.

- (i) Controlled chain of custody.
- (ii) Operator competence - all analysts must be suitably qualified to carry out the required analysis.
- (iii) Certified Reference Materials (CRM). The accuracy of a series of determinations is checked against known standards.
- (iv) Duplicate - 10% duplication is normal.
- (v) Quality Control Charts.
- (vi) Inter Laboratory Testing - The Environmental Limited Laboratories are members of the WASP Interproficiency Testing Scheme and the W.R.C. Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the current EPA Register of Quality Approved Testing Laboratories.

### 3.0 RESULTS

The results of the investigation are detailed in Tables 3.1 and 3.2 below.

**TABLE 3.1: ON-SITE METEOROLOGICAL CONDITIONS**

Warm with strong south-westerly breeze, occasional showers

**TABLE 3.2: RESULTS OF ODOUR ANALYSIS FROM TREATMENT PLANT**

| Location     | Concentration<br>(ou/m <sup>3</sup> ) |
|--------------|---------------------------------------|
| Downwind     | 13                                    |
| House one    | 62                                    |
| House two    | 13                                    |
| Option three | 13                                    |
| Upwind       | 9                                     |

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#### 4.0 COMMENT

An odour is defined as a sensation resulting from the reception of a stimulus by the olfactory sensory system. The way the human response to an odour is evaluated depends on the particular sensory property that is being measured, including the intensity, detectability, character, and hedonic tone (acceptability) of the odour. The combined effect of these properties is related to the annoyance that may be caused by the odour. Odorous air pollutants are often judged important, primarily for their nuisance value and the number of complaints they generate.

By definition  $1\text{ou}/\text{m}^3$  is the detection threshold of 50% of a panel of trained observers working in an odour free environment. The recognition threshold is about 5 times this concentration i.e.  $5\text{ou}/\text{m}^3$ . Moreover, it is generally accepted that odour concentrations between 5 and  $10\text{ou}/\text{m}^3$  above the baseline concentration give rise to a faint odour and that only concentrations greater than  $10\text{ou}/\text{m}^3$  constitute a distinct odour.

The results of the odour assessment undertaken at the proposed location of the Youghal Wastewater Treatment Plant (WWTP), south of the Youghal Landfill site are detailed in Tables 3.1 and 3.2.

Prior to undertaking the sampling, a short site inspection was conducted to subjectively ascertain the existing predominant sources of odour in the vicinity of the proposed wastewater treatment plant location. The location of two of the sampling points was changed in comparison to the previous sampling episode in accordance with the client's instructions. The two new locations were House one (a sensitive receptor) and House two (the nearest sensitive receptor). Furthermore it was indicated by the client that option three was now the preferred location of the WWTP. The wind on the day of sampling was southwesterly in direction. A landfill and tidal mudflat are present to the north or north-east of all the sampling locations. Due to the wind direction these potential odour sources did not contribute to the odour levels measured on the day of sampling.

Samples were taken at each location to ascertain baseline levels. A baseline upwind and downwind sample was taken. Since the wind was southwesterly in direction on the day of sampling, the upwind sample was taken directly south of location three approximately 40m south of the ring road and 40m north of the edge of the town. Although not directly upwind of option three, an odour sample

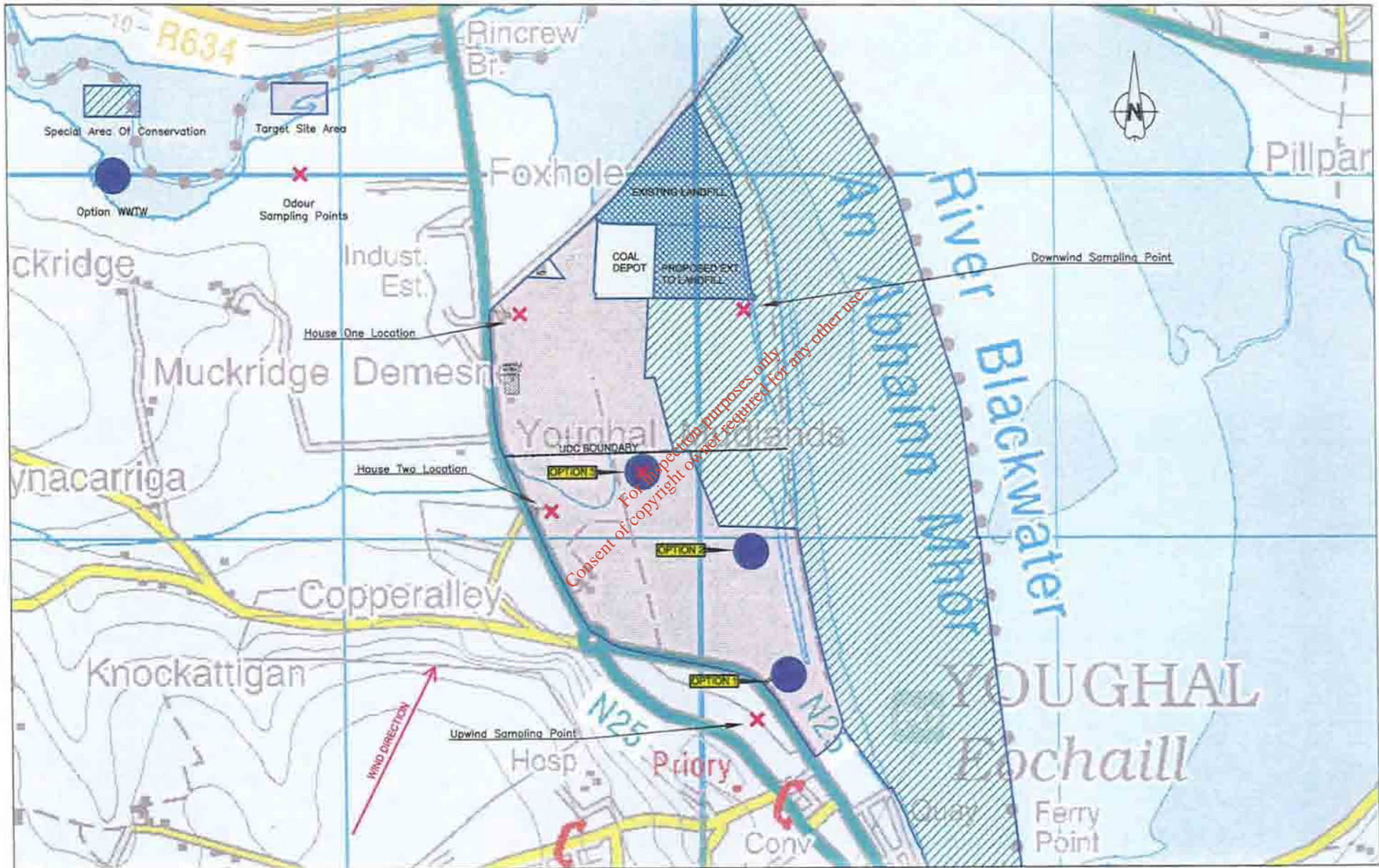
was taken at location five (see drawing 1 in Appendix 1) to maintain sampling continuity. The downwind sample was taken north east of option three, south of the proposed landfill extension. This sampling point is located in the north east corner of the field south of the proposed landfill extension, approximately 5 metres south of the double dyke and 5 metres west of the drainage channel.

In general, it may be stated that normal rural open-air background concentrations typically range from 10 – 25 ou/m<sup>3</sup>. These may occur as a result of natural odour sources (woods, pasture, surface waters etc.) and are not usually considered as being a nuisance.

The baseline levels recorded during this survey range from 9 - 62 ou/m<sup>3</sup>, which with the exception of house one lie within the normal concentrations. In general, the results obtained indicate typical open air-rural background concentrations. It is considered that the source of the odour measured at house one originates from a shed that is adjacent to this location.

In summary, it may be concluded that on the day of monitoring, the general background odour levels in this area range from 9 - 62 ou/m<sup>3</sup>.

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ODOUR MONITORING SURVEY - 15th August 2001

FIGURE J.2

**APPENDIX J3. REPORT FOR ODOUR MONITORING ON 22<sup>ND</sup>  
AUGUST 2001**

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*A BASELINE ODOUR MONITORING SURVEY AT  
YOUGHAL, CO. CORK ON BEHALF OF ATKINS MC  
CARTHY CONSULTING ENGINEERS, VILLA FRANCA,  
DOUGLAS ROAD, CORK*

REPORT NO:

T264

ATTENTION:

Ms. Louise Collier

Atkins McCarthy Consulting Engineers

Villa Franca

Douglas Road

Cork

PREPARED BY:

Sean Creedon

Environmental Consultant

REVIEWED BY:

John Conway

Air Quality Section Head

DATE:

SEPTEMBER 3<sup>RD</sup> 2001

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**EXECUTIVE SUMMARY**

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to conduct a study to determine the existing baseline odour levels in the vicinity of a proposed Wastewater Treatment Plant (WWTP) at Youghal. Following the results of the sampling and analysis carried out on the 4<sup>th</sup> of July, it was felt that further investigation was necessary. As a result an Environmental Consultant from Bord Na Móna Environmental Limited visited the target site area on the 15<sup>th</sup> and 22<sup>nd</sup> of August to carry out further odour monitoring surveys. The results of the sampling on 15<sup>th</sup> of August were presented in report T 261.

The baseline levels recorded during this survey range from 44 - 108 ou/m<sup>3</sup>. There is a marked increase in the odour concentrations measured during this sampling episode in comparison with the previous report. Direct comparison of the results is possible as there was no change in the positions of the sampling sites. Weather conditions on the day of sampling consisted of extended periods of calm with an occasional slight southerly wind. The increase in baseline odour concentrations is a reflection on the difference in weather conditions and its influence on the sampling results. Although high odour values were recorded, the odours on the day of sampling were not nuisance in nature. The odour can be subjectively described as a general agricultural odour. Significant variation in results from baseline ambient odour monitoring is not unusual as the weather conditions on the day of sampling have a large influence on the sampling outcome.

In summary, it may be concluded that the general background odour levels in this area range from 44 - 108 ou/m<sup>3</sup> on the day of sampling.

The report is certified as accurate and representative of the sampling and associated analysis carried out.

Respectively Submitted

**Mr. Sean Creedon**  
Environmental Consultant

**Mr John Conway**  
Air Quality Section Head

**CONTENTS**

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| 1.0 | INTRODUCTION                |
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## 1.0 INTRODUCTION

Atkins McCarthy, Consulting Engineers on behalf of Youghal Urban District Council are presently undertaking an Environmental Impact Statement for the construction of a new sewage treatment works on a green field site in Youghal, Co. Cork . As part of this Environmental Impact Statement they are required to ascertain the baseline odour levels at the proposed locations and in the surrounding environs. There are three proposed options (one, two and three) for the siting of the treatment plant and they are indicated on drawing 1 in Appendix 1.

Bord na Móna Environmental limited was commissioned by Atkins McCarthy, Consulting Engineers to determine these baseline odour levels. A Bord na Móna Environmental Consultant subsequently visited the site on the 22<sup>th</sup> of August 2001 to conduct the monitoring as part of an ongoing effort to determine the baseline odour values. The odour samples were returned to the laboratory for subsequent analysis.

This report presents details of the monitoring programme including sampling and analytical methodologies together with results obtained. In addition a broad interpretation of the results obtained is included.

## 2.0 METHODOLOGY

### 2.1 Sampling Locations

Table 2.1 describes the odour sampling locations which are marked on Drawing 1 in Appendix 1.

| <b>Sampling Location/Source</b> | <b>Justification</b>   |
|---------------------------------|--|
| Downwind                        | To ascertain the baseline odour level Downwind of the proposed WWTP location |
| House one                       | To ascertain the baseline odour level at a sensitive receptor                |
| House two                       | To ascertain the baseline odour level at the nearest sensitive receptor      |
| Option 3                        | To ascertain the baseline odour level at Option 3                            |
| Upwind                          | To ascertain the baseline odour level Upwind of the proposed WWTP location.  |

### 2.2 Odour Sampling and Analysis



For each location a sample of the ambient air of approximately 30 - 40 litres was collected via Teflon tubing into a nalophane gas sampling bag by means of the "lung principle" method. Using this method the sample bag is housed in a sealed carbuoy, which is evacuated using a small air pump. The volume of air removed from the carbuoy is replaced by sample gas entering the bag, thus avoiding contamination of sample by pumps or meters. Sampling was carried out in accordance with German Standard Method VDI 3881 (1987). Each sample was collected at a rate of approximately 4 litres/min for 15mins.

The samples were analysed by Dynamic Olfactometry. The instrument used was an Olfactomat-e Olfactometer (Project Research Amsterdam) and the analytical procedures were in accordance with the CEN Standard TC264 (1999) using a trained panel of 8 assessors. The odour concentration of the sample is expressed in odour units per cubic metre of gas (ou/m<sup>3</sup>). These values, sometimes referred to as "dilutions to threshold" are equivalent to the number of times the sample gas required dilution with odour free air to reach the panels odour threshold (i.e. the concentration at which there is a 50% probability of the panelists detecting the odour).

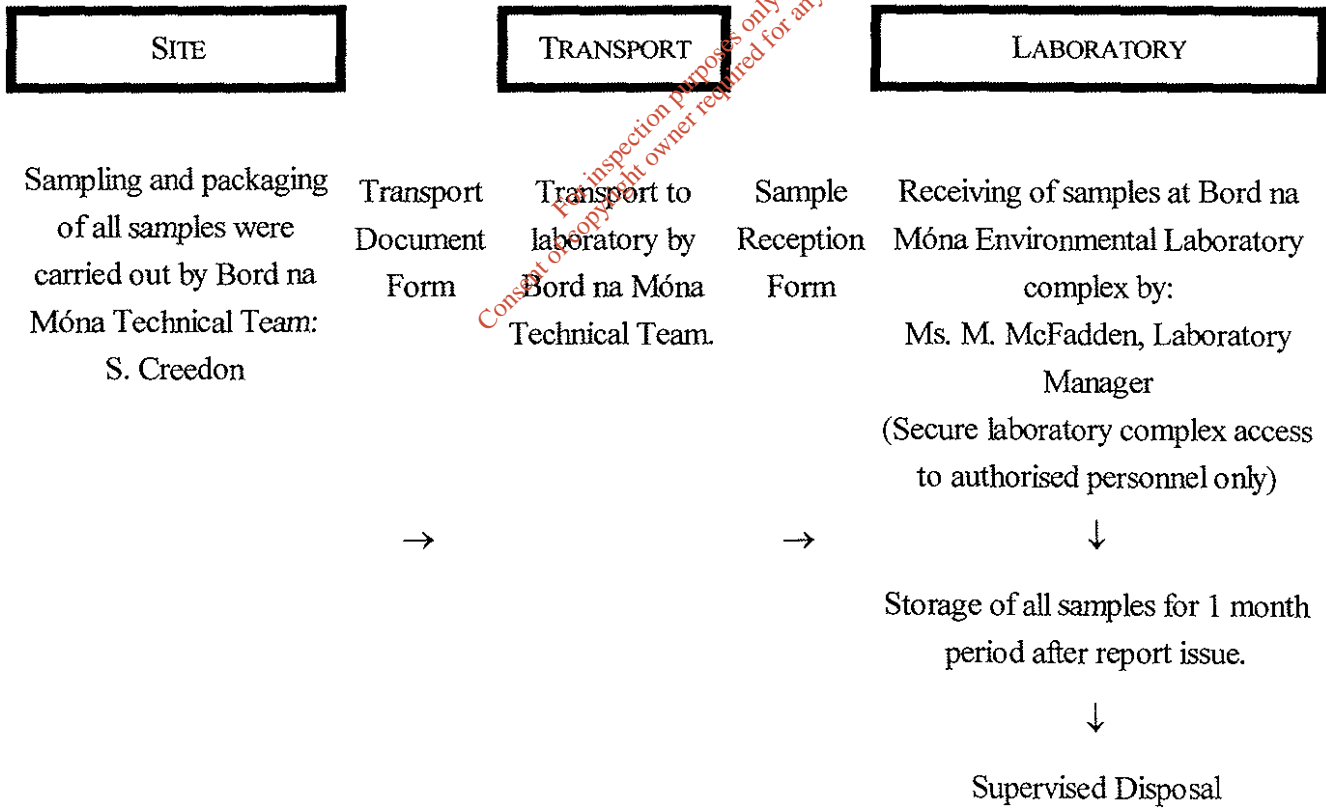
### 2.3 Control Chain Of Custody

As part of the Quality System in place in Bord na Móna, Environmental Limited; measures are taken to ensure controlled chain of custody. An outline of the chain of custody is given overleaf.

# BORD NA MÓNA

BORD NA MÓNA ENVIRONMENTAL LIMITED

## CONTROLLED CHAIN OF CUSTODY



## 2.4 Quality Control

The Environmental Limited Laboratory complex has been awarded ILAB accreditation by the ILAB secretariat. A stringent six-point quality control approach is at present implemented in the laboratories.

- (i) Controlled chain of custody.
- (ii) Operator competence - all analysts must be suitably qualified to carry out the required analysis.
- (iii) Certified Reference Materials (CRM). The accuracy of a series of determinations is checked against known standards.
- (iv) Duplicate - 10% duplication is normal.
- (v) Quality Control Charts.
- (vi) Inter Laboratory Testing - The Environmental Limited Laboratories are members of the WASP Interproficiency Testing Scheme and the W.R.C. Aquacheck Scheme. The Laboratory also participates in the Environmental Protection Agency's Intercalibration Programme and is listed on the current EPA Register of Quality Approved Testing Laboratories.

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### 3.0 RESULTS

The results of the investigation are detailed in Tables 3.1 and 3.2 below.

**TABLE 3.1: ON-SITE METEOROLOGICAL CONDITIONS**

Calm, occasional very slight southerly wind, dull

**TABLE 3.2: RESULTS OF ODOUR ANALYSIS FROM TREATMENT PLANT**

| Location     | Concentration<br>(ou/m <sup>3</sup> ) |
|--------------|---------------------------------------|
| Downwind     | 49                                    |
| House one    | 90                                    |
| House two    | 108                                   |
| Option three | 64                                    |
| Upwind       | 44                                    |

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#### 4.0 COMMENT

An odour is defined as a sensation resulting from the reception of a stimulus by the olfactory sensory system. The way the human response to an odour is evaluated depends on the particular sensory property that is being measured, including the intensity, detectability, character, and hedonic tone (acceptability) of the odour. The combined effect of these properties is related to the annoyance that may be caused by the odour. Odorous air pollutants are often judged important, primarily for their nuisance value and the number of complaints they generate.

By definition  $1\text{ou}/\text{m}^3$  is the detection threshold of 50% of a panel of trained observers working in an odour free environment. The recognition threshold is about 5 times this concentration i.e.  $5\text{ou}/\text{m}^3$ . Moreover, it is generally accepted that odour concentrations between 5 and  $10\text{ou}/\text{m}^3$  above the baseline concentration give rise to a faint odour and that only concentrations greater than  $10\text{ou}/\text{m}^3$  constitute a distinct odour.

The results of the odour assessment undertaken at the proposed location of the Youghal Wastewater Treatment Plant (WWTP), south of the Youghal Landfill site are detailed in Tables 3.1 and 3.2.

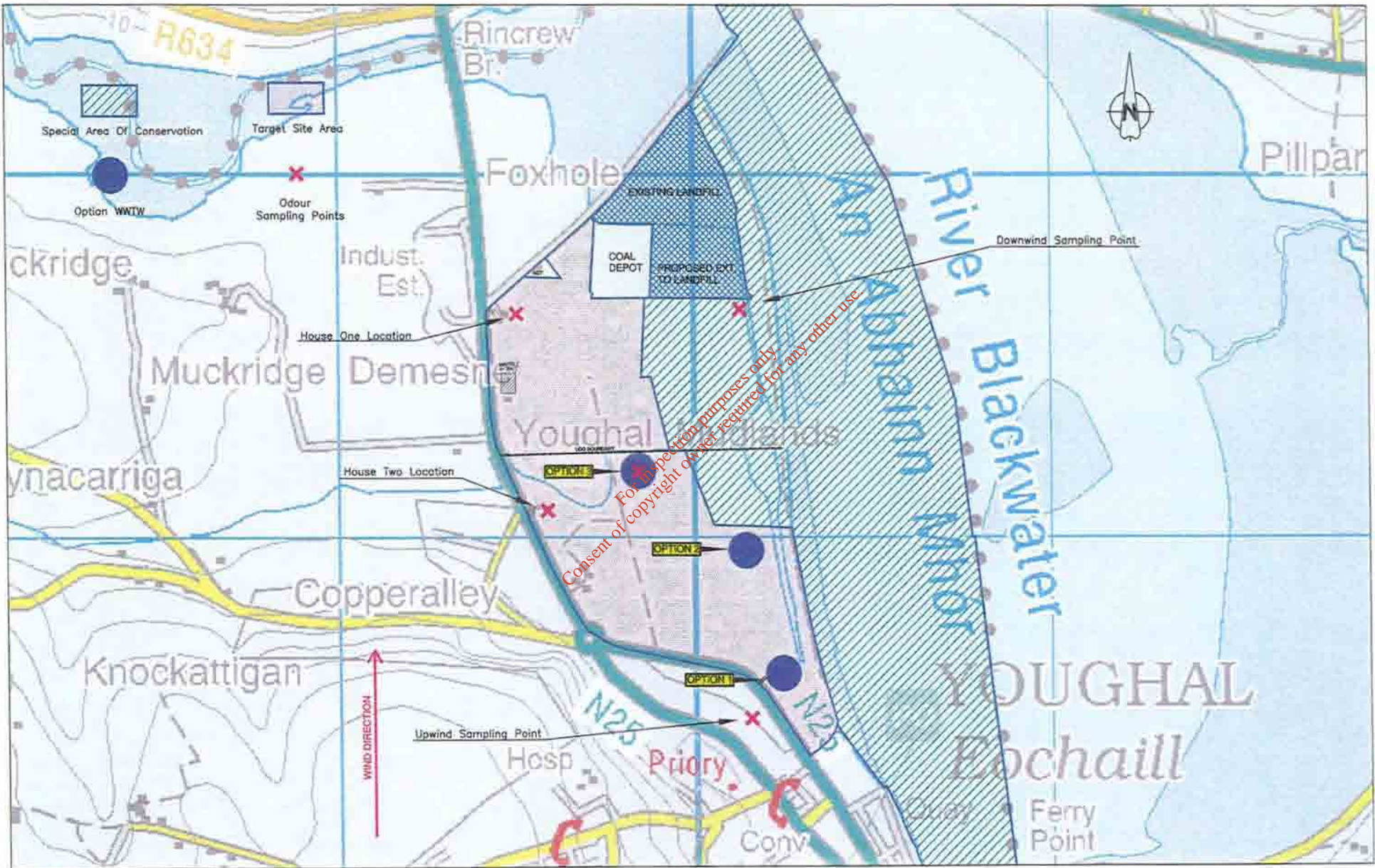
As the purpose of this sampling episode was to generate further odour concentrations for the proposed WWTP site the sampling locations remained identical to the previous report so that a direct comparison could be made. The client indicated that option three was now the preferred location of the WWTP. The wind (southerly) on the day of sampling was very slight. The wind was observed intermittently with extended periods of calm. A landfill and tidal mudflat are present to the north or north-east of all the sampling locations.

Samples were taken at each location to ascertain baseline levels. A baseline upwind and downwind sample was taken. Although the wind was southerly in direction and very slight, samples were taken at the upwind and downwind sites to maintain sampling continuity. The upwind sample was taken directly south of location three approximately 40m south of the ring road and 40m north of the edge of the town. The downwind sample was taken north east of option three, south of the proposed landfill extension. This sampling point is located in the north east corner of the field south of the proposed landfill extension,

approximately 5 metres south of the double dyke and 5 metres west of the drainage channel.

In general, it may be stated that normal rural open-air background concentrations typically range from 10 – 25 ou/m<sup>3</sup>. These may occur as a result of natural odour sources (woods, pasture, surface waters etc.) and are not usually considered as being a nuisance.

The baseline levels recorded during this survey range from 44 - 108 ou/m<sup>3</sup>, which show an increase in odour concentrations of between 28 and 95 ou/m<sup>3</sup> respectively in comparison to the levels measured in the previous sampling episode. The results obtained reflect the weather conditions on the day of sampling. On a calm day with little wind movement, the dispersion of odours is very poor and leads to the build-up of odour concentrations to above the normal 10 – 25 ou/m<sup>3</sup> rural open-air background concentrations. From the subjective assessment of the sites on the day of sampling no single source of odour could be ascertained. The background odour concentrations were of a general agricultural nature. The odours present on the day of sampling were felt not to be nuisance in nature. In summary, it may be concluded that on the day of monitoring, the general background odour levels in this area range from 44 - 108 ou/m<sup>3</sup>. In conclusion the variation in results between the three sampling episodes reflect the vagaries of baseline ambient odour sampling which are extremely dependent on prevailing meteorological conditions.



**APPENDIX K**

**Site Selection Report**

*Atkins McCarthy, Dublin Office.*

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# 1. WASTEWATER TREATMENT WORKS SITE SELECTION

## INTRODUCTION

- 1.1 This Section sets out the criteria and procedures for the selection of an appropriate site for the treatment of wastewater from the existing and future development of Youghal. This includes an assessment of the selected sites over the search area based on the selection criteria which are based on both environmental and economic issues. A site for the proposed works is recommended following this thorough assessment.

## DESCRIPTION OF SEARCH AREA

- 1.2 The town of Youghal is located on the coast of East County Cork, at the mouth of the River Blackwater. Youghal is located on the main Cork City (51km) to Waterford (72km) road and is a port of considerable antiquity.
- 1.3 The search area for the site is indicated on Figure P001 and a number of suitable sites have been identified within this area. The search area is centred on the town of Youghal and the extent of area was confined to a distance of 4km from the centre of the town which would provide sufficient number of sites for consideration.

## Topography

- 1.4 Youghal is located on the west of the side of the mouth of the River Blackwater Estuary, with the town itself steeply sloping from the high point to the west at 80.0mOD to 0.0mOD at the River. To the north of the town the lands flatten out in the vicinity of the Youghal Mudlands and the Tourig River before rising sharply again at the Blackwater / Tourig confluence with Rincrew at 80.0+mOD and to the east of the Blackwater in County Waterford at 100.0mOD. Lands to the west of the town in the area of the Cork Road also rise gently to the north at Knocknacally from 10.0m to 60.0mOD and flatten out to the south towards the sea at the Ballyvergan Marshes which are a significant feature before reaching the long beaches stretching for several kilometers from Redbarn to Moll Goggin's Corner.
- 1.5 Lands to the east of the Estuary in Co. Waterford are also steeply sloping to the River with only one or two areas (e.g. Newtown / Blackbog, Kinsalebeg) being relatively flat and at a low level (20.0-10.0mOD). The areas at the harbour mouth at Monatray and Esat Point are also steeply sloping and very visible from the town of Youghal rising to a level of 80.0mOD.
- 1.6 The estuary itself is tidal with a significant portion of the estuary drying out at low tide resulting in large areas of mudflats. The estuary has a distinctive narrowing due to a shingle spit extending from the east side of the estuary known as Ferry Point.

## Land Use

- 1.7 Outside the built up areas of the town the land use is agricultural, mainly tillage and grazing. There are a number of other land uses and land designation of note in the search area. These include:
- Landfill site to the north of the town;
  - A number of proposed National Heritage Areas (NHA's);

- Special Protection Areas (SPA) and Special Areas of Conservation (SAC) under the Birds and Habitat Directive at a number of locations in the Tourig / Blackwater estuary, Ballyvergan Marshes and the Womanagh River Estuary.

1.8 Lands within the Urban District Boundary have been zoned in the Development Plan (Variation 1999). The majority of the lands are zoned for various forms of development including Town Centre and Non Retail Uses, Residential and Tourist Development. The only exceptions relate to the community facility land use zoning based mainly on the Golf Club Lands at the 'top' of the town and the open space zoning at the Youghal Mudlands between the N25 and the UDC boundary (and south of the existing landfill). The land use zoning map for Youghal is included in the Main Report (Vol2).

### **Overview of Existing Sewerage System**

1.9 The existing sewerage system is indicated in overview in Figure P002. It is, in the main, a combined system with storm and foul sewage being carried in the same piped system. The system is split into two catchments, to the north and south of the town. The southern catchment constitutes approximately 30 to 35% of the total and covers the areas along the sea frontage from Paxe's Lane to Moll Goggin's and all areas along the Cork Road as far as Summerhill. Sewage from the area is collected at the pumping station at Williamstown and is transferred in towards the town centre to a comminutor station at Greens Park and then discharged untreated via a 200mm long outfall to the estuary from Paxes Lane.

1.10 The northern catchment covers the majority (70%) of the town and discharges untreated sewage via an outfall at the low water mark some 150m from Green's Quay adjacent to the Youghal Shipping and the sothern end of the sea wall to the the north of the town. There is a pumping station at Dunnes Park which is required to discharge the effluent against high tides.

## **SITE SELECTION CRITERIA AND CONSTRAINTS**

- 1.11 In selecting the sites for consideration there are a number of criteria and constraints which will inform the decision making process. These are described below:

### **Ecological and Heritage Designations**

- 1.12 The NHA's and Special Protection Areas (SPA's) for birds and habitats should be avoided if at all possible. These include the Ballyvergan Marshes, the Estuary and the SPA at Foxhole. The archaeological SMR sites which are identified in the Development Plan should also be avoided.

### **Proximity to Existing and Future Development**

- 1.13 Lands which are currently used as Residential (or other development) along with future zoned lands should be avoided where possible due to potential environmental impacts due to odour, noise, visual impact and traffic. Whilst it is possible to construct a WWTW in a built up area the perception of the facility must be considered and is therefore desirable that a buffer distance be provided between the WWTW and development.

### **Proximity to the Drainage Catchment and Outfall**

- 1.14 It is important that the WWTW is located as close as possible, subject to the proximity issue discussed above, to the drainage catchment to minimise the extent of pipework / pumping to be provided. Optimal use of the existing drainage configuration will result in a more economical solution. This should be balanced by the proximity to the potential outfall locations. The options for outfalls in the case of Youghal are discharge to the estuary or to the coast via along sea outfall from the Main beach in Youghal.

## **Receiving Waters and Levels of Treatment**

- 1.15 The proposed outfall locations as discussed previously in the report indicate options which include for a short sea outfall which can discharge to the estuary in the vicinity of the existing outfalls or a long sea outfall off the Claycastle Williamstown Beach area. The long and short outfall options and locations will have differing treatment requirements based on the water quality objectives as set out previously. Discharge to the estuary will require secondary and advanced treatment for nutrient reduction and also including possible disinfection. A long sea outfall to the sea requires only high rate secondary treatment and possibly disinfection if a shorter outfall is considered.

## **Land Ownership**

- 1.16 The ownership of the land, while not critical, could be very beneficial if already in the ownership of the UDC or County Council. This would obviate the need for a CPO and Public Hearing to acquire the land. However, it is absolutely essential that such choice is not overly influenced by ownership and the site should also have strong attributes on economic and environmental issues.

## **Area**

- 1.17 A sufficient amount of land should be available both for the current envisaged needs and also for expansion of the works at a future stage. The approximate requirement in the case of Youghal is 2 to 3 ha for a conventional secondary treatment works. Smaller areas would be required for proprietary small footprint plants.

### **Access**

- 1.18 It is important that suitable access be available both for the construction phase and for the operational phase to cater for staff and more importantly for sludge transportation off site.

### **Land Use Zoning**

- 1.19 It is important that the WWTW is consistent with Council Policy and is a “normally permitted” use or at least “open for consideration” within the context of the land use matrix in the Development Plan. The Land Use Zoning is shown in Figure 2.2 Main Report Vol 2.

### **Construction Considerations**

- 1.20 Considerations which impact on the construction of the works need to be addressed as they will impact on costs. Such considerations include the ground conditions which impact on the foundations requirements and topography of the site in terms of level and slope.

## **SITE OPTIONS**

- 1.21 Based on the above, a constraints map has been produced and is indicated in Fig. P003 along with the selected sites. The sites were selected to give wide ranging coverage of potential options in every part of the catchment such that a thorough and comprehensive environmental and economic assessment would result in the most suitable location.

- 1.22 The sites are indicated in Table 1 and take into account selection criteria and constraints set out above:

**Table 1 Site options and locations (**

| <b>Site</b> | <b>Location</b>                    |
|-------------|------------------------------------|
| Site A      | Landfill site (Mudlands)           |
| Site B      | Mudlands                           |
| Site C      | Williamstown(Rear Front Strand)    |
| Site D      | Springfield (Adjacent Water Tower) |
| Site E      | Ballyvergan West (Killeagh Road)   |
| Site F      | Newtown (Co. Waterford)            |
| Site G      | Ballyvegan Marshes (Killeagh Road) |

### **SITES ASSESSMENT**

- 1.23 The following is an assessment of the selected sites based on the criteria set out above.

#### **Site A Landfill Site**

- 1.24 This site is proposed to be located at or adjacent to the existing landfill site and is located outside the UDC boundary. The lands are in ownership of the County Council and more lands have been recently acquired by Youghal UDC for the expansion of the landfill site. The County Council have made an application for a licence from the EPA to continue with the landfill site and for its expansion into the recently acquired site.

- 1.25 ***Sewerage system Configuration*** - The configuration of the collection system is shown in Figure P004. Pipework configuration requires transfer pumping and pipework as follows:

- upgrade of the existing Williamstown Pumping Station to transfer flows from the southern catchment to the northern catchment;
- new pipework to a new pumping station in the vicinity of Dunnes Park in the northern catchment;
- pipework to and from the WWTW at the landfill;
- and a new outfall to a point south of Ferry Point with high levels of treatment;
- An alternative discharge to a long sea outfall would require lower levels of treatment but requires a significant length of land based outfall along with a long marine outfall but with lesser pipework to the site due to closer proximity to the existing catchment.

**1.26 Proximity to catchment and outfall location** – The site is located approximately 1 km to the north of the existing outfall at Greens Quay. It is relatively close to an estuary outfall but significantly remote from a long sea outfall option with 2 to 3 km of effluent mains before reaching the foreshore.

**1.27 Receiving Waters and Levels of Treatment** – the receiving waters from this site can be either of the two options of the Estuary or the Sea. Advanced treatment will be required for the Estuary discharge (including Nutrient reduction and disinfection) or high rate secondary treatment for the long sea outfall or shorter sea outfall with disinfection. These will all impact on costs to a lesser or greater extent.

**1.28 Access** - The site has good access from the N25. In the next two years at end 2003 the by pass of the town will be completed and there will be significant reduction in traffic on this segment of road. In either case the road is suitable for both construction and operational phases of the scheme.

**1.29 Land Use and Planning** -.The site is currently in use as landfill and is therefore considered suitable for consideration for the location of the proposed WWTW. However the site is intended to be utilised as a landfill by Cork County Council



including the area to the south recently acquired for its extension. It is therefore not available for use as a WWTW.

- 1.30 **Odour and Noise** – The site is relatively remote from residential development and impacts from noise and odour would be low risk.
- 1.31 **Ground Conditions** -. The existing site is highly unsuitable due to the presence of unconsolidated and municipal solid waste which generate methane gases.
- 1.32 **Heritage and Archaeology** the site is not affected by archaeology.
- 1.33 **Habitat** – An assessment indicates that no significant habitats are affected
- 1.34 **Visual Impact** –There is a low impact on the visual amenity from the N25 area due to natural screening from the existing hedgerows. The view from the sea wall would be impacted to some extent and also high level views from Cork Hill area.

#### **Site B – Mudlands Area (options 1,2&3)**

- 1.35 The area is located in the north of the town in the Youghal Mudflats. The lands are characterised by generally low lying and are below the level of the High Tides. However the lands are protected by the sea wall constructed in the Famine era when the lands were reclaimed from the estuary. Inflow of sea water to the Mudlands are controlled by a sluice in the sea wall which protects the lands from inundation by the tidal waters. The mudlands are also fed with a freshwater stream from the west which discharges to a saline lake located immediately adjacent to the seawall and which ultimately flows to the estuary via the sluice. The lands can flood to a small degree if high tide conditions coincide with a significant rain storm which occurs on a very infrequent basis. The lands are currently used for grazing and tillage. Some of the lands are not suitable for tillage due to marshy type soils characterised by reeds and other marshy vegetation.
- 1.36 This area includes a number sites which are open for consideration including one in the ownership of the County Council. Three options were assessed as detailed in the

following assessment with a recommendation to select a site in the area to bring forward for comparison with the other site options. These site options are indicated in Figure 4.1 of the Main Report Vol 2.

1.37 ***Sewerage system Configuration*** - The configuration of the collection system is shown in Figure P005. Pipework configuration is similar to that of the Landfill Site A with identical transfer pumping and pipework as follows:

- upgrade of the existing Williamstown Pumping Station to transfer flows from the southern catchment to the northern catchment
- new pipework to a new pumping station in the vicinity of Dunnes Park in the northern catchment
- pipework to and from the WWTW at the landfill
- and a new outfall to a point south of Ferry Point with high levels of treatment.
- An alternative discharge to a long sea outfall would require lower levels of treatment but requires a significant length of land based outfall along with a long marine outfall but with lesser pipework to the site due to closer proximity to the existing catchment

1.38 ***Proximity to catchment and outfall location*** – Option 1 in this area is located close to the existing outfall and the proposed estuarine outfall location. However, despite it being in Council ownership is quite close to the existing development in Dominic Collins Park with potential visual and odour impacts. The other options 2 & 3 further north is more remote and more favourable from this perspective with the nearest properties to the west on the N25 over 250m away to Site 3 and 500m from site 2. On balance the more remote sites are favoured.

1.39 ***Receiving Waters and Levels of Treatment*** – the receiving waters from this site can be either of the two options of the Estuary or the Sea. Advanced treatment will be required for the Estuary discharge (including Nutrient reduction and disinfection) or high rate secondary treatment for the long sea outfall or shorter sea outfall with disinfection. These will all impact on costs to a lesser or greater extent.

- 1.40 **Access** - All sites have good access from the N25. In the next two years at end 2003 the by pass of the town will be completed and there will be significant reduction in traffic on this segment of road. In either case the road is suitable for both construction and operational phases of the scheme.
- 1.41 **Land Use and Planning** -.The site was zoned as Commercial in the original 1997 Plan but was amended subsequently in the 1999 Variation to the Development Plan The variation also made provision for consideration of the proposed WWTW in the open space zoning if further studies should indicate its suitability at the location. The sites in this area are therefore considered suitable for consideration for the location of the proposed WWTW.
- 1.42 **Odour and Noise** –the more remote options 2 & 3 are more favourable than site 1 due to the proximity to development of site 1. A modelling assessment indicates lesser risk of odour perception at Site 2 & 3 which would also have lesser constructional phase impacts e.g. noise and dust impacts.
- 1.43 **Ground Conditions** - Additional site development costs due to ground conditions are likely on all three sites due to the nature of the low lying land and the lands have been reclaimed Assessment of borehole data for the site indicates that ground improvement techniques or piling of the structures will be required. This will impact on costs.
- 1.44 **Heritage and Archaeology** – None of the sites are affected by archaeology.
- 1.45 **Habitat** – An assessment indicates that no significant habitats are affected and the sites were chosen to avoid the Special area of Conservation designation in the Mudlands which is confined to the eastern area in the vicinity of the saline lake.
- 1.46 **Visual Impact** – an analysis of the area indicates that option 3 in this area would be most suitable due to its remoteness and the natural screening. Additional screening can be provided on the exposed side. This assessment is detailed in the Environmental

- 1.51 **Proximity to catchment and outfall location** –The site is located off the Cork road in the southern catchment and immediately adjacent to the Main beach from where the sea outfall would begin.
- 1.52 **Receiving Waters and Levels of Treatment** – the receiving waters from this site would be high rate secondary treatment for the long sea outfall or shorter sea outfall with disinfection.
- 1.53 **Access** - The site has good access from the Cork Road.
- 1.54 **Land Use and Planning** -. Land is zoned for Tourist Related Development and the WWTW would not be consistent with the zoning. The site is subject to flooding and there are proposals to provide flood attenuation measures on the site. (Ref: Engineering Aspects of Proposal for Tourism Development of Lands at Williamstown / Claycastle for CHL Consulting Ltd on behalf of Youghal UDC by MC O’Sullivan & Co. Ltd 1998 )
- 1.55 **Odour and Noise** – The site is a high risk area for noise and odour both during construction and operation as the site is surrounded by development in close proximity.
- 1.56 **Ground Conditions** -. The site has unsuitable ground conditions for construction due to the wetlands nature of the site.
- 1.57 **Heritage and Archaeology** the site is not affected by archaeology.
- 1.58 **Habitat** – The proposed development would have a significant impact on the wetland habitats in this area.
- 1.59 **Visual Impact** –Due to the proximity of development the site would have a serious impact on visual amenity.

## Site D – Springfield

- 1.60 This site is in the ownership of UDC and is located in the area of Cork Hill on the elevated section to the north of the town and is in the ownership of the UDC.
- 1.61 ***Sewerage system Configuration*** - Pipework configuration requires transfer pumping and pipework as follows:
- upgrade of the existing Williamstown Pumping Station to transfer flows from the southern catchment to the northern catchment;
  - new pipework to a new pumping station in the vicinity of Dunnes Park in the northern catchment to transfer to the WWTW;
  - pipework to and from the WWTW;
  - and a new outfall to a point south of Ferry Point with high levels of treatment;
  - An alternative discharge to a long sea outfall would require lower levels of treatment but requires a significant length of land based outfall along with a long marine outfall but with lesser pipework to the site due to closer proximity to the existing catchment.
- 1.62 ***Proximity to catchment and outfall location*** –The site is located off Cork Hill and is remote from outfall location options by comparison with the other options. It is also at a significant elevation (70 m O.D) resulting in very significant pumping costs.
- 1.63 ***Receiving Waters and Levels of Treatment*** – the receiving waters from this site can be either of the two options of the Estuary or the Sea. Advanced treatment will be required for the Estuary discharge (including Nutrient reduction and disinfection) or high rate secondary treatment for the long sea outfall or shorter sea outfall with disinfection. These will all impact on costs to a lesser or greater extent.
- 1.64 ***Access*** - The site has poor access from the Cork Hill road which is very steep and residential. Access to the area either via the town or county roads and therefore not suitable either for construction or operation.

- 1.65 **Land Use and Planning** :-The site is zoned as Community Facilities (CF) which would lend itself to amenity development consistent with the Golf Club which constitutes the majority of the zoned area in this location. A WWTW would not be consistent with this objective;
- 1.66 **Odour and Noise** – The site is a high risk area for noise and odour both during construction and operation as the site is surrounded by development in close proximity (Blackwater Heights).
- 1.67 **Ground Conditions** -. The site appears to have suitable ground conditions for construction.
- 1.68 **Heritage and Archaeology** the site is not affected by archaeology.
- 1.69 **Habitat** – The proposed development would not have a significant impact on the any habitats in this area.
- 1.70 **Visual Impact** –Due to the proximity of development the site would have a serious impact on visual amenity.

#### **Site E - Ballyvergan West**

- 1.71 This site has been selected as an option on the west side of the town on the north side of the N25 Cork Road beyond the Ballymacoda Road junction and adjacent to the proposed junction at the by pass. This is some 4km from the town centre and is outside the UDC boundary. The site is gently sloping initially and then increases in gradient significantly. The site has the following attributes to recommend it as described below.
- 1.72 **Sewerage system Configuration** - The configuration of the collection system is indicated in Figure P006. The northern catchment (60-70% of the town) is transferred by pumping station to the southern catchment and all flows further transferred to the

WWTW site by a new pumping station in the existing station at Williamstown or an upgrade to the existing. The outfall from the site can be via a long outfall from the Claycastle / Williamstown beach. The site is sufficiently elevated to allow for discharge via the outfall without pumping.

- 1.73 **Proximity to catchment and outfall location** – This site is approximately 4km from the town and therefore quite remote from development but with the issue of significant transfer pipeline costs. There are some small number of residences nearby within 200m. The outfall is also remote from the site with long effluent pipeline required.
- 1.74 **Receiving Waters and Levels of Treatment** – the receiving waters from this site would be the Sea with high rate secondary treatment for the long sea outfall or shorter sea outfall with disinfection. These will all impact on costs to a lesser or greater extent.
- 1.75 **Access** – Good access is available from the wide straight stretch of the N25. This section of the N25 will become less busy on completion of the by pass in 2003 and would be usable for both the construction and operational phase of the scheme.
- 1.76 **Land Use and Planning** -.The site is zoned for agriculture and currently under grazing and is located outside the UDC boundary. Any development other than agriculture related is considered to be a material contravention of the Development Plan and the site would need to be rezoned in advance of any proposed development.
- 1.77 **Odour and Noise** – The site location is remote and issues of odour and noise are not likely to have any impact in either the construction or operational phase.
- 1.78 **Ground Conditions** – the ground conditions on site are relatively good and special consideration of ground improvement techniques are not likely.
- 1.79 **Heritage and Archaeology** –the site is not affected by archaeology.

- 1.80 **Habitat** – An assessment indicates that no significant habitats are affected and is not affected by Special Area of Conservation or other habitat.
- 1.81 **Visual Impact** – an analysis of the area indicates the site has a significant impact upon the landscape due to the high profile nature of the site which is rising to the north and has a very open aspect which is highly visible to passing traffic but due to the remoteness does not impact on residences except the local individual properties. Due to its openness and elevation it would be difficult to screen the site and will result in some residual impact on the landscape.
- 1.82 **Amenity & Recreational** – the construction of the outfall pipelines will impact for a short period during the construction phase on the amenity of the beach which will likely need to be restricted in the area of the outfall which would require to be constructed during the summer season during calm weather conditions which would coincide with the peak tourist season. Measures will be required to ensure safety of the public and measures to reduce impact on the beach amenity. The impact is unlikely to be significant given the extent and length of the beach in this area.

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## Site F - Newtown (Co. Waterford)

- 1.83 The area on the east side of the Estuary has very few suitable locations due to the steeply sloping topography. The site selected is at Newtown which is relatively flat area. The assessment of the site is described below.
- 1.84 **Sewrage system Configuration** - The configuration of the collection system is shown in Figure P007. Pipework configuration is similar to that of the Landfill Site A and Site B at Mudlands with transfer pumping and pipework as follows:
- upgrade of the existing Williamstown Pumping Station to transfer flows from the southern catchment to the northern catchment;
  - new pipework to a new pumping station in the vicinity of Dunnes Park in the northern catchment;
  - pipework to the WWTW across the estuary;
  - and a new outfall to a point south of Ferry Point.
- 1.85 **Proximity to catchment and outfall location** – This site is approximately 2km from the town on the Waterford side of the estuary and therefore quite remote from development but with the issue of significant transfer pipeline costs across the estuary due to constructing under tidal water and also due to high current conditions in the area of Ferry Point. There are some small number of residences nearby within 400m. The outfall is relatively close to the site with short effluent pipeline required to the estuary.
- 1.86 **Receiving Waters and Levels of Treatment** – the receiving waters from this site will be the Estuary.. Advanced treatment will be required for the Estuary discharge (including Nutrient reduction and disinfection). These will all impact on costs.
- 1.87 **Access** – Access to this site is poor from the local county road serving the Newtown area which links to the N25 at some 1.5km from the site. The road is unsuitable particularly for construction traffic or for sludge tankering in the operational phase.

- 1.88 **Land Use and Planning**-The site is zoned for agriculture and currently under grazing and is located outside the UDC boundary.. Full planning permission would be required from Waterford County Council as the works would be outside the functional area of Cork County Council or Youghal UDC. There may be difficulties and risk associated with pursuing this option both on a planning and political level.
- 1.89 **Odour and Noise** – The site location is remote and issues of odour and noise are not likely to have any impact in either the construction or operational phase.
- 1.90 **Ground Conditions** – the ground conditions on site are relatively good and special consideration of ground improvement techniques are not likely.
- 1.91 **Heritage and Archaeology** –the site is not affected by archaeology.
- 1.92 **Habitat** – An assessment indicates that no significant habitats are affected and is not affected by Special area of Conservation or other habitat. However the construction of the transfer and outfall pipelines are through designated areas for conservation and while the impacts are only likely to be temporal during the construction phase it is nonetheless undesirable.
- 1.93 **Landscape & Visual** – an analysis of the area indicates the site would not have a significant impact upon the landscape with local screening and bunding being sufficient to screen the site from local residential aspects.

### **Site H - Ballvergan Marshes**

- 1.94 This site is located to the south of the N25 on the west side of Youghal and is adjacent to Claycastle / Williamstown beaches. This site is being considered in the context of possibly using the marshes as a natural reed bed treatment system.
- 1.95 The marshes are a proposed Natural Heritage Area (Site Ref: Nr. 78) and has been designated as A Special Protection Area. It is difficult to predict the long term impact of the use of the marshes as either a secondary treatment or “polishing” treatment system. To establish the potential impacts on the marshes of the effluent would require significant specialist research into the use of the marshes including the habitat and ecosystems the results of which may be inconclusive. A significant difficulty in the potential use of the Marshes relates to the distribution of the effluent throughout the marsh without adversely impacting on the marsh during construction as it is likely that distribution pipework would be necessary. The stream running through the marsh discharges at the Williamstown / Claycastle Beach and may also adversely impact on the bathing water quality of the beach.
- 1.96 Due to the above issues the use of the marshes is therefore precluded from further consideration.

### **SUMMARY**

- 1.97 To summarise the environmental assessment of the site options a scoring system is applied. Scores vary from 0 to 4 i.e. from neutral to high impact with the highest score resulting in the least favoured environmentally. The following Table 2 summarises the assessments for the selected sites.

**Table 2 Summary Environmental Assessment**

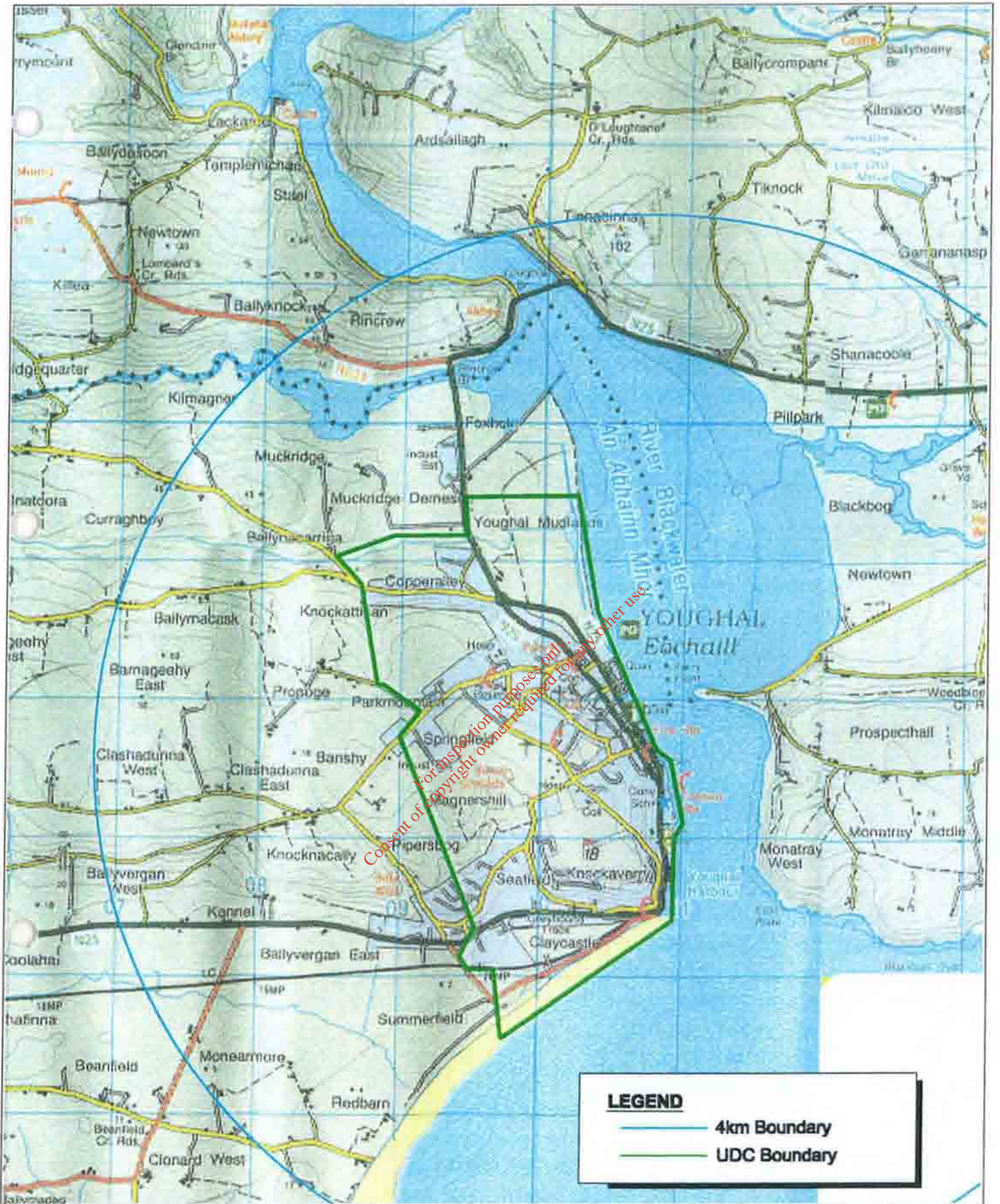
| Site | Location            | Landscape and Visual | Access | Habitat | Heritage | Land Use and Planning | Odour & Noise Risk | Proximity to development | Total Score | Rank |
|------|---------------------|----------------------|--------|---------|----------|-----------------------|--------------------|--------------------------|-------------|------|
| A    | Landfill            | 1                    | 0      | 0       | 0        | 4                     | 1                  | 1                        | 7           | 2    |
| B    | Mudlands            | 1                    | 0      | 1       | 0        | 0                     | 1                  | 1                        | 4           | 1    |
| C    | Williamstown        | 4                    | 1      | 4       | 0        | 4                     | 2                  | 4                        | 19          | 7    |
| D    | Springfield         | 3                    | 2      | 1       | 0        | 3                     | 3                  | 3                        | 15          | 6    |
| E    | Ballyvergan West    | 3                    | 0      | 1       | 0        | 2                     | 1                  | 1                        | 8           | 3    |
| F    | Newtown             | 2                    | 4      | 1       | 0        | 3                     | 1                  | 1                        | 12          | 4    |
| G    | Ballyvergan Marshes | 4                    | 0      | 4       | 0        | 4                     | 1                  | 0                        | 13          | 5    |

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## SITE SELECTION SUMMARY & RECOMMENDATION

- 1.98 Based on the above analysis the Mudlands area is the lowest score and is ranked the most suitable from an environmental perspective.
- 1.99 A number of the sites under consideration will now be curtailed to three sites (B, E and F), with the least environmentally favourable sites (C,D and G) being excluded from the economic analysis. While the landfill site (A) is ranked in second place it is not being considered further for the reasons outlined earlier.
- 1.100 This site in the Mudlands to the north of Youghal is therefore the recommended site for the proposed wastewater treatment works for Youghal.

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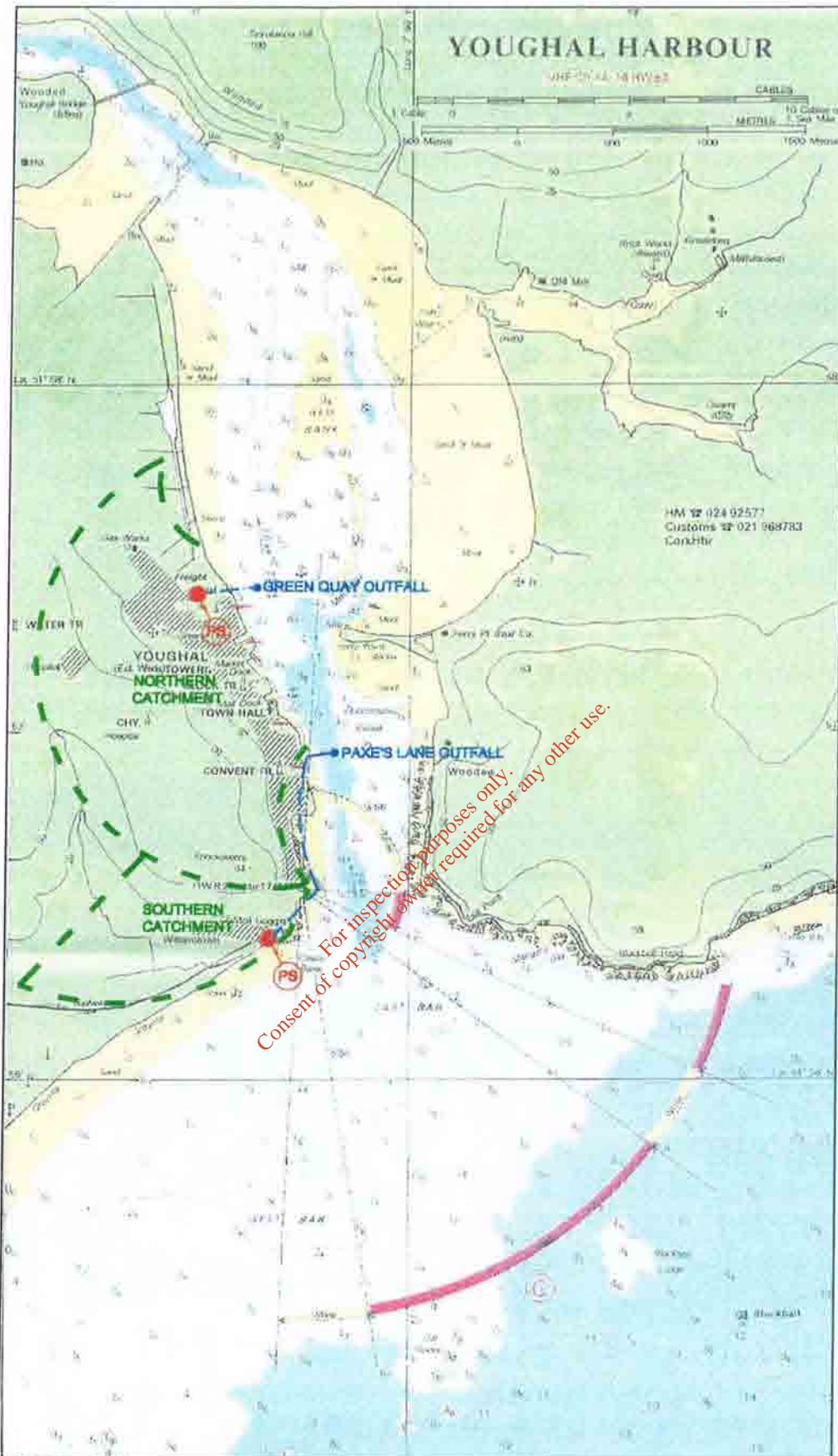


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**LEGEND**

- 4km Boundary
- UDC Boundary

|   |  |        |        |                                      |                                |                    |  |
|---|--|--------|--------|--------------------------------------|--------------------------------|--------------------|--|
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|   |  |        |        | Drawing Title <b>Search Area</b>     |                                |                    |  |
|   |  | Scale  | Drawn  | Ch'ked                               | Auth                           |                    |  |
|   |  | NTS    | Date   | Date                                 | Date                           | Date               |  |
|   |  | 131200 |        |                                      |                                |                    |  |
| <b>DRAFT FOR COMMENT</b>  |  | GH     | DEC.00 | A                                    |                                |                    |  |
| Purpose of issue  |  | Auth   | Date   | Rev                                  | Description                    | By Date Chk'd Auth |  |
|   |  |        |        |                                      | Drawing Number <b>1721P001</b> |                    |  |
|   |  |        |        |                                      | Rev <b>A</b>                   |                    |  |



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Project **YOUGHAL MAIN DRAINAGE**

Drawing Title  
**Existing Catchment Overview**

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|-------|--------|--------|------|
| Scale | Drawn  | Ch'ked | Auth |
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|       | Date   | Date   | Date |
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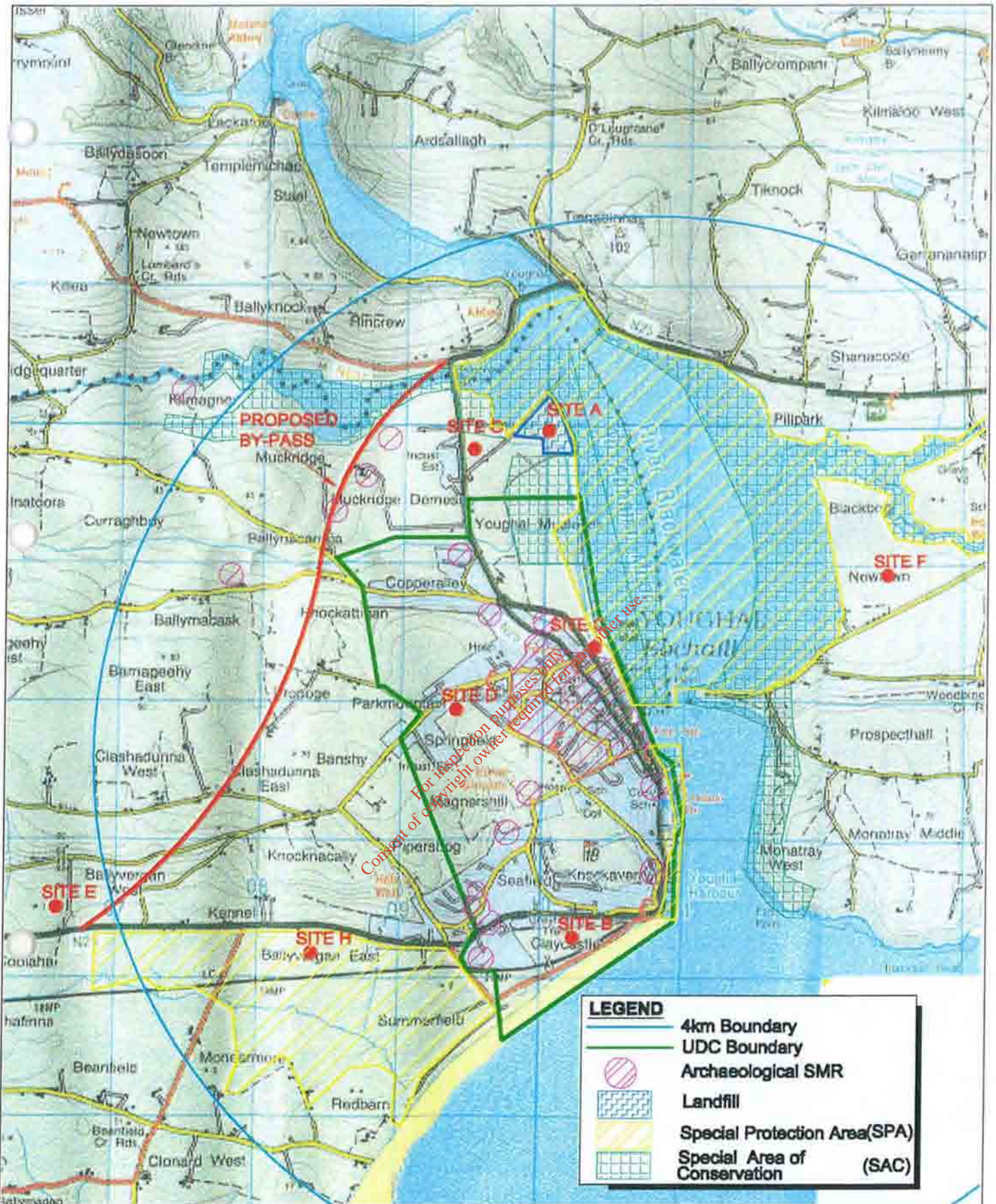
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Drawing Number  
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Rev  
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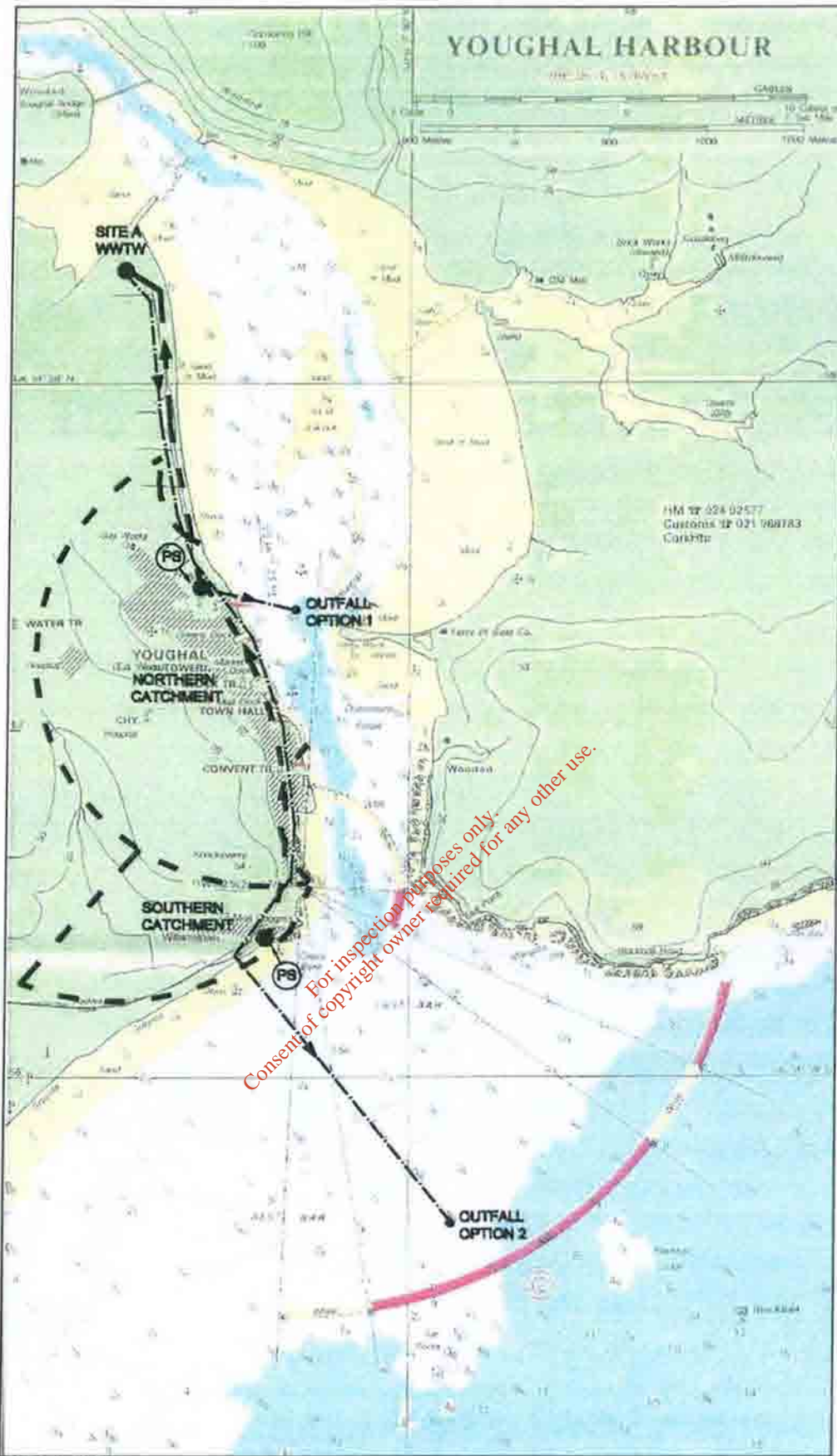


**LEGEND**

- 4km Boundary
- UDC Boundary
- Archaeological SMR
- Landfill
- Special Protection Area (SPA)
- Special Area of Conservation (SAC)



|   |           |  |          |   |                                      |              |
|---|-----------|--|----------|---|--------------------------------------|--------------|
| <h2 style="margin: 0;">Atkins McCarthy</h2> |           | <h2 style="margin: 0;">Atkins</h2>                       |          |   | Project <b>YOUGHAL MAIN DRAINAGE</b> |              |
| Balgriffin House<br>Balgriffin<br>Dublin 17 |           | Tel. (+353) 01 8470310/8460000<br>Fax. (+353) 01 8470310 |          | <b>Constraints Map and Site Locations</b> |                                      |              |
|   |           |  |          | Scale <b>NTS</b>                          | Drawn <b>GH</b>                      | Ch'ked       |
|   |           |  |          | Date <b>131200</b>                        | Date                                 | Auth         |
|   |           |  |          | Drawing Number <b>1721P003</b>            |                                      | Rev <b>A</b> |
| <b>DRAFT FOR COMMENT</b>                    | <b>GH</b> | <b>DEC.00</b>  | <b>A</b> |   |                                      |              |
| Purpose of issue                            | Auth      | Date   | Rev      | Description                               | By                                   | Date         |
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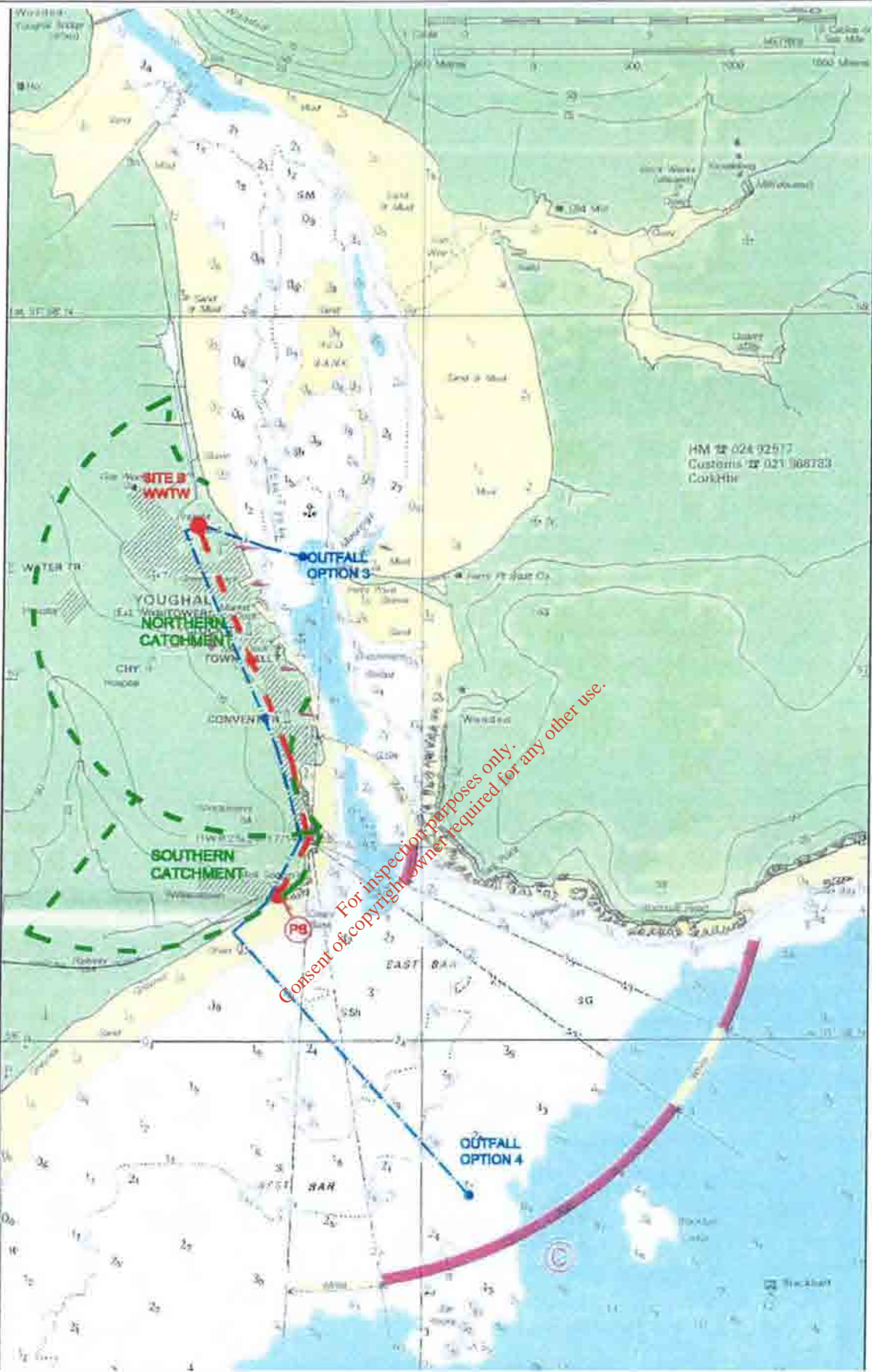




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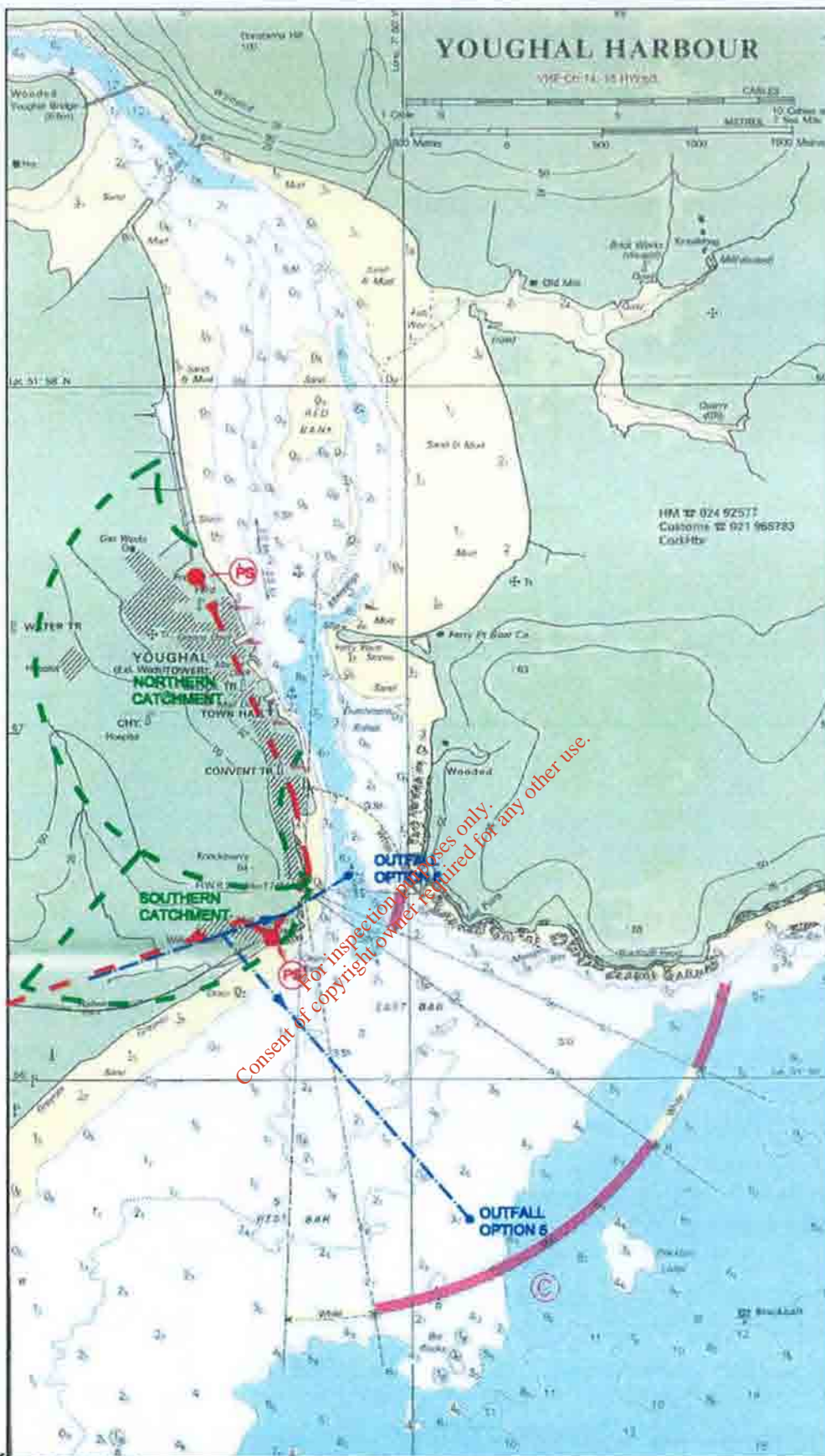
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|   |  |  |                | Drawing Title<br><b>Site A, Landfill,<br/>         Collection System + Outfall Options</b> |                    |
| Scale<br><b>NTS</b>   |  | Drawn<br><b>GH</b><br>Date<br><b>131200</b>  | Ch'ked<br>Date | Auth<br>Date   |                    |
| Drawing Number<br><b>1721P004</b>   |  |  |                | Rev<br><b>A</b>  |                    |
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|   |  |   |  |   |  | Drawing Title <b>Site B WWTW, Dunnes Park, Collection System + Outfall Options</b> |  |
| <b>DRAFT FOR COMMENT</b>  |  | <b>GH DEC.00 A</b>  |  |   |  | Scale <b>NTS</b>   |  |
| Purpose of issue  |  | Auth Date Rev   |  | Description By Date Chk'd Auth  |  | Drawing Number <b>1721P005</b>   |  |
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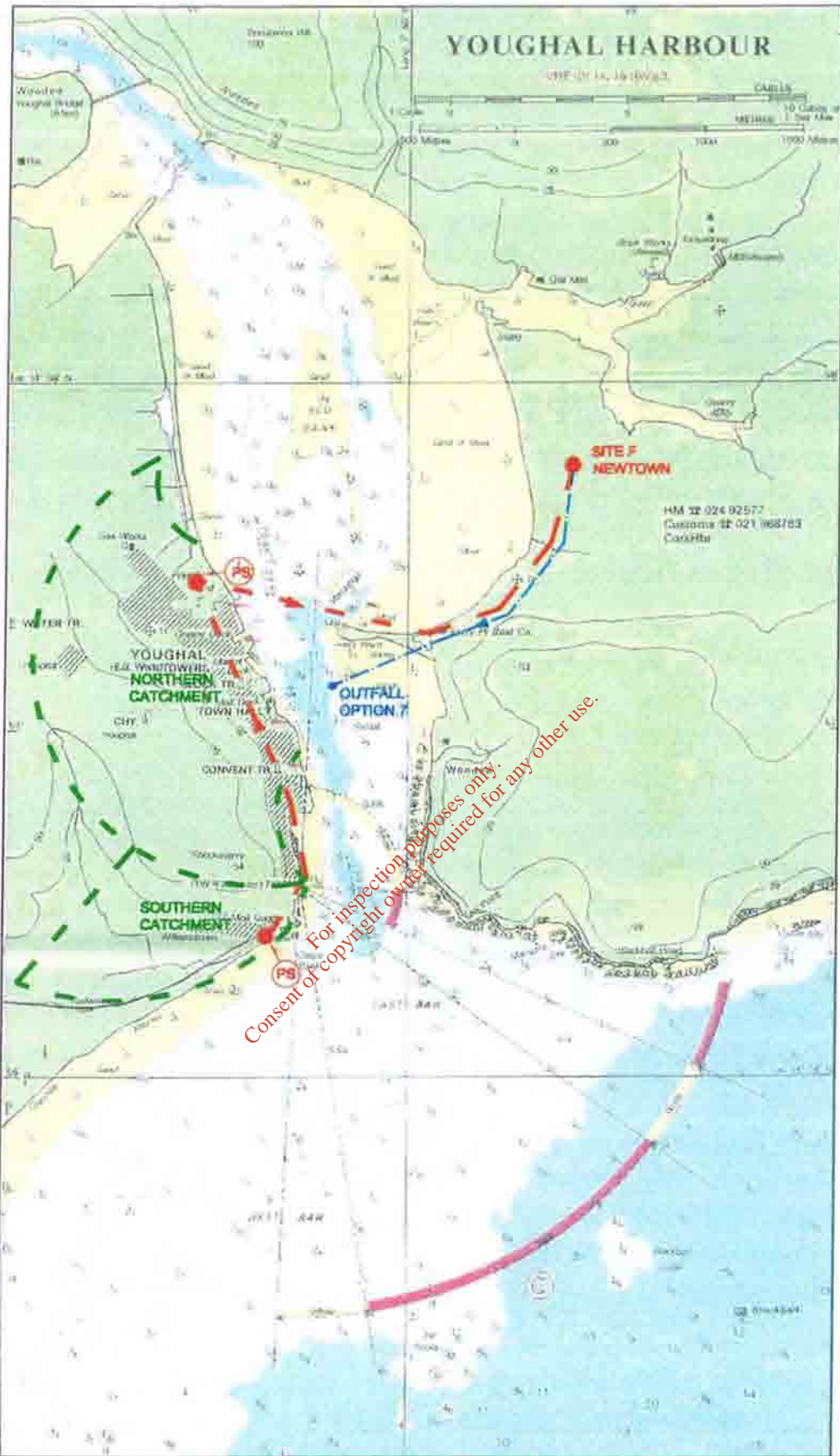
Project **YOUGHAL MAIN DRAINAGE**

Drawing Title **Site E WWTW, Ballyvergan West, Collection System + Outfall Options**

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Project

**YOUGHAL MAIN DRAINAGE**

Drawing Title

**Site F WWTW, Newton (Co. Waterford)  
Collection System + Outfall**

Scale  
NTS

Drawn  
GH  
Date  
131200

Ch'ked  
Date

Auth  
Date

**DRAFT FOR COMMENT**

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Purpose of issue

Auth Date Rev

Description

By Date

Chk'd Auth

Drawing Number

**1721P007**

Rev

**A**



# **An Assessment of the Trophic Status of Estuaries and Bays in Ireland**

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LOCAL GOVERNMENT**

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**ENVIRONMENTAL PROTECTION AGENCY**  
An Ghníomhaireacht um Chaomhnú Comhshaoil

### Annex 3 Summary Water Quality Statistics and Compliance with Criteria (Contd.)

| Waterbody                                     | Code <sup>1</sup> | Zone                                | Type        | Salinity<br>psu |    |        |     | DIN<br>mg/l N |    |        | MRP<br>ug/l P |        |            | Chlorophyll a (Summer)<br>mg/m <sup>3</sup> |    |        | Dissolved Oxygen<br>(Summer) % sat |      |       |        |    |     |     |  |
|---|-------------------|-------------------------------------|-------------|-----------------|----|--------|-----|---------------|----|--------|---------------|--------|------------|---|----|--------|------------------------------------|------|-------|--------|----|-----|-----|--|
|   |                   |                                     |             | Winter          | No | Summer | No  | Winter        | No | Summer | No            | Winter | No         | Summer                                      | No | Median | 90%ile                             | No   | 5%ile | 95%ile | No |     |     |  |
| <b>Blackwater Estuary and Youghal Harbour</b> |                   |                                     |             |                 |    |        |     |               |    |        |               |        |            |   |    |        |                                    |      |       |        |    |     |     |  |
| R   |                   | Blackwater River                    | Fresh       |                 |    | 0.1    | 7   | <b>RID</b>    |    |        | 0.00          | 8      | <b>RID</b> |   |    | 24     | 9                                  |      |       |        |    |     |     |  |
| E8a   |                   | Blackwater Estuary Upper            | Tidal Fresh |                 |    | 0.1    | 18  |               |    |        | 0.11          | 16     |            |   |    | 18     |                                    | 1.55 | 8.5   | 17     | 70 | 94  | 24  |  |
| E8b   |                   | Blackwater Estuary Lower            | Estuary     |                 |    | 16.2   | 75  |               |    |        | 1.52          | 73     |            |   | 28 | 75     |                                    | 11.1 | 35.4  | 73     | 74 | 127 | 85  |  |
| E9  |                   | Youghal Harbour                     | Outer       |                 |    | 32.7   | 11  |               |    |        | 0.198         | 11     |            |   | 7  | 11     |                                    | 4.8  | 15.7  | 11     | 95 | 120 | 13  |  |
| <b>Lee Estuary and Cork Harbour</b>           |                   |                                     |             |                 |    |        |     |               |    |        |               |        |            |   |    |        |                                    |      |       |        |    |     |     |  |
| R   |                   | Lee River                           | Fresh       |                 |    |        |     | <b>RID</b>    |    |        |               |        | 38         | <b>RID</b>                                  |    |        |                                    |      |       |        |    |     |     |  |
| E26a  |                   | Lee Estuary / Lough Mabon           | Estuary     | 13.5            | 8  | 25.2   | 199 | <b>RID</b>    | 8  |        | 0.06          | 188    | 56         | 22  |    | 202    |                                    | 6.9  | 30.0  | 185    | 73 | 111 | 261 |  |
| E26b  |                   | Owennacutra Estuary / North Channel | Estuary     | 14.8            | 2  | 19.0   | 28  |               | 2  |        | 1.072         | 26     | 27         | 2   | 19 | 30     |                                    | 8.5  | 25.0  | 25     | 75 | 135 | 35  |  |
| E27   |                   | Cork Harbour                        | Outer       | 33.4            | 6  | 33.6   | 163 |               | 6  |        | 0.072         | 133    | 30         | 17  | 9  | 143    |                                    | 7.7  | 20.8  | 163    | 86 | 119 | 200 |  |
| <b>Bandon Estuary and Kinsale Harbour</b>     |                   |                                     |             |                 |    |        |     |               |    |        |               |        |            |   |    |        |                                    |      |       |        |    |     |     |  |
| R   |                   | Bandon River                        | Fresh       |                 |    | 0.1    | 11  | <b>RID</b>    |    |        | 0.03          | 11     | 53         | <b>RID</b>                                  |    | 11     |                                    |      |       |        |    |     |     |  |
| E1a   |                   | Upper Bandon Estuary <sup>2</sup>   | Tidal Fresh | 8.8             | 24 | 17.9   | 104 | <b>RID</b>    | 24 |        | 1.133         | 104    | 40         | 24  | 30 | 104    |                                    | 27   | 35.9  | 100    | 77 | 152 | 125 |  |
| E1b   |                   | Lower Bandon Estuary                | Estuary     | 24.3            | 18 | 32.0   | 77  |               | 18 |        | 0.117         | 77     | 20         | 18  | 11 | 77     |                                    | 19.0 | 3.0   | 77     | 82 | 116 | 92  |  |
| E2  |                   | Kinsale Harbour                     | Outer       | 33.0            | 9  | 34.2   | 31  |               | 9  |        | 0.030         | 31     | 17         | 9   | 7  | 29     |                                    | 5.2  | 13.7  | 31     | 89 | 135 | 35  |  |
| <b>Lee (Tralee) Estuary and Tralee Bay</b>    |                   |                                     |             |                 |    |        |     |               |    |        |               |        |            |   |    |        |                                    |      |       |        |    |     |     |  |
| R   |                   | Lee River and tributaries           | Fresh       |                 |    | 0.1    | 17  |               |    |        | 1.690         | 19     |            |   |    | 19     |                                    |      |       |        |    |     |     |  |
| E28a  |                   | Upper Lee (Tralee) Estuary          | Upper       |                 |    | 1.8    | 29  |               |    |        | 1.740         | 32     |            |   |    | 32     |                                    | 12.7 | 7.6   | 24     | 72 | 113 | 30  |  |
| E28b  |                   | Lower Lee (Tralee) Estuary          | Estuary     |                 |    | 30.4   | 22  |               |    |        | 0.062         | 22     |            |   | 26 | 22     |                                    | 11.0 | 16.8  | 22     | 71 | 117 | 22  |  |
| E29   |                   | Tralee Bay                          | Outer       |                 |    | 33.2   | 99  |               |    |        | 0.018         | 99     |            |   | 10 | 99     |                                    | 2.0  | 5.7   | 99     | 93 | 114 | 107 |  |

Non-Compliance indicated by bold type and shaded cell

RID denotes data sourced from the riverine inputs surveys

R denotes a non-tidal river

<sup>1</sup> Code numbers identify corresponding location symbols on maps in Annex 4

<sup>2</sup> includes tidal freshwaters

### Annex 3 Summary Water Quality Statistics and Compliance with Criteria (Contd.)

| Waterbody                                     |                                     |             | Salinity<br>psu |    |        |     | DIN<br>mg/l N |     |              |     | MRP<br>ug/l P |     |        |    | Chlorophyll a (Summer)<br>mg/m <sup>3</sup> |        |            | Dissolved Oxygen<br>(Summer) % sat |             |           |           |            |     |    |
|---|-------------------------------------|-------------|-----------------|----|--------|-----|---------------|-----|--------------|-----|---------------|-----|--------|----|---|--------|------------|------------------------------------|-------------|-----------|-----------|------------|-----|----|
|   |                                     |             | Winter          | No | Summer | No  | Winter        | No  | Summer       | No  | Winter        | No  | Summer | No | Median                                      | 90%ile | No         | 5%ile                              | 95%ile      | No        |           |            |     |    |
| <b>Blackwater Estuary and Youghal Harbour</b> |                                     |             |                 |    |        |     |               |     |              |     |               |     |        |    |   |        |            |                                    |             |           |           |            |     |    |
| R   | Blackwater River                    | Fresh       |                 |    | 0.1    | 7   | <b>0.59</b>   | RID | <b>0.007</b> | 8   | <b>0.007</b>  | RID |        |    |   | 9      |            |                                    |             |           |           |            |     |    |
| E8a   | Blackwater Estuary Upper            | Tidal Fresh |                 |    | 0.1    | 18  |               |     | <b>0.125</b> | 16  |               |     |        |    |   | 18     | <b>1.6</b> | <b>1.85</b>                        | 17          | 70        | 94        | 21         |     |    |
| E8b   | Blackwater Estuary Lower            | Estuary     |                 |    | 16.2   | 75  |               |     | <b>1.39</b>  | 73  |               |     |        |    |   | 28     | <b>75</b>  | <b>51.4</b>                        | 73          | 74        | 127       | 85         |     |    |
| E9  | Youghal Harbour                     | Outer       |                 |    | 32.7   | 11  |               |     | <b>0.198</b> | 11  |               |     |        |    |   | 7      | <b>4.8</b> | <b>15.7</b>                        | 11          | 95        | 120       | 13         |     |    |
| <b>Lee Estuary and Cork Harbour</b>           |                                     |             |                 |    |        |     |               |     |              |     |               |     |        |    |   |        |            |                                    |             |           |           |            |     |    |
| R   | Lee River                           | Fresh       |                 |    |        |     |               | RID |              |     | <b>38</b>     | RID |        |    |   |        |            |                                    |             |           |           |            |     |    |
| E26a  | Lee Estuary / Lough Mahon           | Estuary     | 13.5            | 8  | 25.2   | 199 | <b>0.11</b>   | 8   | <b>0.05</b>  | 138 | <b>86</b>     | 22  |        |    |   | 202    | 6.9        | <b>10.0</b>                        | 185         | <b>11</b> |           | 111        | 261 |    |
| E26b  | Owennacurra Estuary / North Channel | Estuary     | 14.8            | 2  | 19.0   | 23  | <b>0.078</b>  | 2   | <b>1.072</b> | 26  | <b>27</b>     | 2   |        |    |   | 19     | 30         | 8.5                                | 25.0        | 25        | 75        | <b>35</b>  | 35  |    |
| E27   | Cork Harbour                        | Outer       | 33.4            | 6  | 33.6   | 163 | <b>0.05</b>   | 6   | <b>0.072</b> | 133 | <b>30</b>     | 17  |        |    |   | 9      | 143        | 7.7                                | 20.8        | 163       | 86        | <b>119</b> | 200 |    |
| <b>Bandon Estuary and Kinsale Harbour</b>     |                                     |             |                 |    |        |     |               |     |              |     |               |     |        |    |   |        |            |                                    |             |           |           |            |     |    |
| R   | Bandon River                        | Fresh       |                 |    | 0.1    | 11  | <b>0.36</b>   | RID | <b>0.13</b>  | 11  | <b>53</b>     | RID |        |    |   | 11     |            |                                    |             |           |           |            |     |    |
| E1a   | Upper Bandon Estuary <sup>1</sup>   | Tidal Fresh | 8.8             | 24 | 17.9   | 104 | <b>0.55</b>   | 24  | <b>1.133</b> | 104 | <b>40</b>     | 24  |        |    |   | 30     | 104        | <b>2.6</b>                         | <b>3.59</b> | 100       | 77        | <b>152</b> | 125 |    |
| E1b   | Lower Bandon Estuary                | Estuary     | 24.3            | 18 | 32.0   | 77  | <b>0.130</b>  | 18  | <b>0.117</b> | 77  | <b>20</b>     | 18  |        |    |   | 11     | 77         | <b>12.0</b>                        | <b>25.0</b> | 77        | 82        | <b>15</b>  | 92  |    |
| E2  | Kinsale Harbour                     | Outer       | 33.0            | 9  | 34.2   | 31  | <b>0.030</b>  | 9   | <b>0.030</b> | 31  | <b>17</b>     | 9   |        |    |   | 7      | 29         | 5.2                                | 13.7        | 31        | 89        | <b>113</b> | 35  |    |
| <b>Lee (Tralee) Estuary and Tralee Bay</b>    |                                     |             |                 |    |        |     |               |     |              |     |               |     |        |    |   |        |            |                                    |             |           |           |            |     |    |
| R   | Lee River and tributaries           | Fresh       |                 |    | 0.1    | 17  |               |     | <b>1.690</b> | 19  |               |     |        |    |   | 19     |            |                                    |             |           |           |            |     |    |
| E28a  | Upper Lee (Tralee) Estuary          | Upper       |                 |    | 1.8    | 29  |               |     | <b>1.740</b> | 32  |               |     |        |    |   | 32     |            | <b>12.7</b>                        | <b>21</b>   | 24        | <b>42</b> |            | 113 | 30 |
| E28b  | Lower Lee (Tralee) Estuary          | Estuary     |                 |    | 30.4   | 22  |               |     | <b>0.062</b> | 22  |               |     |        |    |   | 26     | 22         | 11.0                               | 16.8        | 22        | <b>75</b> |            | 117 | 22 |
| E29   | Tralee Bay                          | Outer       |                 |    | 33.2   | 99  |               |     | <b>0.018</b> | 99  |               |     |        |    |   | 10     | 99         | 2.0                                | 5.7         | 99        | 93        | <b>114</b> | 107 |    |

Non-Compliance indicated by bold type and shaded cell  
 RID denotes data sourced from the riverine inputs surveys  
 R denotes a non-tidal river  
<sup>1</sup> Code numbers identify corresponding location symbols on maps in Annex 4  
<sup>2</sup> Includes tidal freshwaters

# APPENDIX L

## Water Quality Data

*Atkins McCarthy, Dublin Office.*

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Table L.1. Water quality data collected for this study (20-April-01).

| Parameters              | Units               | Samples collected at Low Water |       |       |       |       | Samples collected at High Water |       |       |       |       |       |      |
|-------------------------|---------------------|--------------------------------|-------|-------|-------|-------|---------------------------------|-------|-------|-------|-------|-------|------|
|                         |                     | Site                           | 1     | 2     | 4     | 6     | 7                               | 1     | 4     | 6     | 7     | 8     | 9    |
| <i>B.O.D.</i>           | mgO <sub>2</sub> /l |                                | 1.3   | 2.0   | 0.9   | 0.8   | 1.1                             | 0.8   | 0.9   | 1.0   | 1.0   | 0.7   | 0.9  |
| <i>Ammonia</i>          | mgN/l               |                                | 0.072 | 0.06  | 0.061 | 0.064 | 0.054                           | 0.056 | 0.056 | 0.071 | 0.055 | 0.046 | 0.06 |
| <i>Nitrite</i>          | mg N/l              |                                | 0.004 | 0.002 | 0.005 | 0.005 | 0.005                           | 0.002 | 0.003 | 0.002 | 0.001 | 0.002 | 0.00 |
| <i>Nitrate</i>          | mgN/l               |                                | 0.75  | 0.03  | 1.32  | 1.49  | 1.55                            | 0.32  | 0.53  | 0.05  | 0.10  | 0.31  | 0.05 |
| <i>Total Nitrogen</i>   | mgN/l               |                                | 0.95  | 0.24  | 1.64  | 1.72  | 1.75                            | 0.49  | 0.72  | 0.31  | 0.33  | 0.45  | 0.31 |
| <i>Orthophosphate</i>   | mgP/l               |                                | 0.003 | 0.000 | 0.009 | 0.011 | 0.013                           | 0.001 | 0.003 | 0.000 | 0.001 | 0.001 | 0.00 |
| <i>Total P</i>          | mgP/l               |                                | 0.022 | 0.015 | 0.031 | 0.034 | 0.042                           | 0.017 | 0.023 | 0.017 | 0.017 | 0.015 | 0.01 |
| <i>Suspended Solids</i> | mg/l                |                                | 6.3   | 8.8   | 5.0   | 9.7   | 23.2                            | 6.2   | 1.0   | 6.8   | 6.1   | 3.6   | 2.2  |
| <i>Chlorophyll a</i>    | mg/m <sup>3</sup>   |                                | 10.84 | 15.01 | 8.44  | 8.97  | 11.05                           | 13.03 | 8.97  | 13.34 | 12.93 | 11.36 | 10.9 |
| <i>Salinity</i>         | ‰                   |                                | 26.6  | 33.5  | 22.8  | 21.3  | 20.8                            | 31.3  | 29.6  | 33.7  | 33.3  | 31.7  | 33.2 |
| <i>Total Coliforms</i>  | CFU/100 mls         |                                | 29    | 26    | 27    | 28    | 400                             | 1     | 19    | 38    | 400   | 18    | 2    |
| <i>Faecal Coliforms</i> | CFU/100 mls         |                                | 10    | 10    | 3     | 5     | 64                              | 0     | 9     | 34    | 84    | 7     | 0    |

Note: Sediment samples only were collected at Site 3.

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Table L.2. Water Quality data collected by the Environmental Protection Agency in 1994 (EPA, unpublished data).

| Sample No. | Date          | BOD<br>(mg/l) | Ammonia<br>(mg/l N) | NO3<br>(mg/l N) | o-P <sup>3</sup><br>(mg/l P) | Chi-a<br>(mg/m3) | Salinity<br>(ppt) |
|------------|---------------|---------------|---------------------|-----------------|------------------------------|------------------|-------------------|
| 0.1        | 18-May-94     | 0.9           | 0.06                | 0.30            | 0.01                         | 2.50             | 31.3              |
| 0.1        | 10-Nov-94     |               | 0.04                |                 | 0.04                         | 2.00             | 29.2              |
| <b>0.1</b> | <b>Median</b> | <b>0.9</b>    | <b>0.05</b>         | <b>0.3</b>      | <b>0.02</b>                  | <b>2.25</b>      |                   |
| 0.2        | 10-Nov-94     |               | 0.03                |                 | 0.03                         | 1.30             | 30.5              |
| 1          | 18-May-94     | 1.0           | 0.05                | 0.40            | 0.01                         | 5.00             | 29.0              |
| 1          | 10-Nov-94     |               | 0.06                |                 | 0.05                         | <b>10.10</b>     | 25.9              |
| 1          | 10-Nov-94     |               | 0.06                |                 | 0.06                         | 4.20             | 24.5              |
| <b>1</b>   | <b>Median</b> | <b>1</b>      | <b>0.06</b>         | <b>0.40</b>     | <b>0.05</b>                  | <b>5.00</b>      |                   |
| 2          | 18-May-94     | 0.7           | 0.06                | 0.70            | 0.01                         | 2.50             | 27.2              |
| 2          | 10-Nov-94     |               | 0.07                |                 | 0.07                         | 6.90             | 20.2              |
| <b>2</b>   | <b>Median</b> | <b>0.7</b>    | <b>0.07</b>         | <b>0.7</b>      | <b>0.04</b>                  | <b>4.70</b>      |                   |
| 3          | 18-May-94     | 0.6           | 0.06                | 0.90            | 0.01                         | 2.50             | 26.8              |
| 3          | 10-Nov-94     |               | 0.03                |                 | 0.03                         | 1.20             | 31.6              |
| 3          | 10-Nov-94     |               | 0.11                |                 | 0.09                         | <b>11.60</b>     | 16.4              |
| <b>3</b>   | <b>Median</b> | <b>0.6</b>    | <b>0.06</b>         | <b>0.9</b>      | <b>0.03</b>                  | <b>2.50</b>      |                   |
| 4          | 18-May-94     | 0.7           | 0.05                | 1.20            | 0.01                         | 3.80             | 22.1              |
| 4          | 18-May-94     | 0.6           | 0.07                | 1.40            | 0.01                         | 5.00             | 20.4              |
| 4          | 10-Nov-94     |               | 0.14                |                 | 0.12                         | 1.80             | 13.0              |
| 4          | 10-Nov-94     |               | 0.15                |                 | 0.12                         | 7.10             | 8.3               |
| <b>4</b>   | <b>Median</b> | <b>0.7</b>    | <b>0.11</b>         | <b>1.30</b>     | <b>0.07</b>                  | <b>4.40</b>      |                   |
| 5          | 18-May-94     | 1.2           | 0.06                | 1.10            | 0.05                         | 7.50             | 16.6              |
| 5          | 18-May-94     | 0.8           | 0.06                | 1.60            | 0.06                         | 6.30             | 17.9              |
| 5          | 10-Nov-94     |               | 0.12                |                 | 0.11                         | <b>13.10</b>     | 14.0              |
| <b>5</b>   | <b>Median</b> | <b>1.0</b>    | <b>0.06</b>         | <b>1.35</b>     | <b>0.06</b>                  | <b>7.50</b>      |                   |
| 5.5        | 18-May-94     | 0.9           | 0.07                | 2.20            | 0.06                         | 2.50             | 11.9              |
| 5.5        | 18-May-94     | 0.9           | 0.07                | 1.80            | 0.06                         | 5.00             | 16.7              |
| 5.5        | 10-Nov-94     |               | 0.14                |                 | 0.12                         | <b>11.30</b>     | 7.4               |
| <b>5.5</b> | <b>Median</b> | <b>0.9</b>    | <b>0.07</b>         | <b>2.00</b>     | <b>0.06</b>                  | <b>5.00</b>      |                   |
| 6          | 18-May-94     | 0.8           | 0.07                | 2.20            | 0.06                         | 5.00             | 10.2              |
| 6          | 18-May-94     | 0.7           | 0.08                | 2.40            | 0.06                         | 2.50             | 8.8               |
| 6          | 10-Nov-94     |               | 0.13                |                 | 0.12                         | <b>12.30</b>     | 5.6               |
| <b>6</b>   | <b>Median</b> | <b>0.8</b>    | <b>0.08</b>         | <b>2.30</b>     | <b>0.06</b>                  | <b>5.00</b>      |                   |

| Sample No.     | Date          | BOD<br>(mg/l) | Ammonia<br>(mg/l N) | NO3<br>(mg/l N) | o-P<br>(mg/l P) | Chl-a<br>(mg/m3) | Salinity<br>(ppt) |
|----------------|---------------|---------------|---------------------|-----------------|-----------------|------------------|-------------------|
| 6.5            | 18-May-94     | 1.2           | 0.07                | 2.40            | 0.06            | 5.00             | 8.1               |
| 6.5            | 18-May-94     | 0.9           | 0.06                | 2.60            | 0.06            | 5.00             | 8.4               |
| 6.5            | 10-Nov-94     |               | 0.16                |                 | 0.14            | 16.10            | 3.9               |
| 6.5            | <b>Median</b> | <b>1.1</b>    | <b>0.07</b>         | <b>2.50</b>     | <b>0.06</b>     | <b>5.00</b>      |                   |
| 7              | 18-May-94     | 1.2           | 0.06                | 2.70            | 0.06            | 2.60             | 6.4               |
| 7              | 18-May-94     | 1.0           | 0.06                | 3.40            | 0.06            | 3.80             | 3.8               |
| 7              | 10-Nov-94     |               | 0.14                |                 | 0.14            | 15.70            | 0.6               |
| 7              | <b>Median</b> | <b>1.1</b>    | <b>0.06</b>         | <b>3.05</b>     | <b>0.06</b>     | <b>3.80</b>      |                   |
| 7.5            | 18-May-94     | 1.2           | 0.06                | 3.40            | 0.02            | 7.50             | 2.2               |
| 7.5            | 18-May-94     | 1.0           | 0.05                | 3.60            | 0.04            | 3.80             | 1.2               |
| 7.5            | <b>Median</b> | <b>1.1</b>    | <b>0.06</b>         | <b>3.50</b>     | <b>0.03</b>     | <b>5.65</b>      |                   |
| 8              | 18-May-94     | 1.2           | 0.06                | 3.70            | 0.03            | 3.80             | 0.2               |
| 8              | 18-May-94     | 1.0           | 0.05                | 3.60            | 0.02            | 2.50             | 0.2               |
| 8              | 10-Nov-94     |               | 0.14                |                 | 0.13            | 6.80             | 0.0               |
| 8              | <b>Median</b> | <b>1.1</b>    | <b>0.06</b>         | <b>3.65</b>     | <b>0.03</b>     | <b>3.80</b>      |                   |
| 8.5            | 18-May-94     | 1.5           | 0.05                | 3.70            | 0.02            | 6.30             | 0.1               |
| 8.5            | 18-May-94     | 1.3           | 0.04                | 3.70            | 0.02            | 6.30             | 0.1               |
| 8.5            | 10-Nov-94     |               | 0.16                |                 | 0.13            | 9.30             | 0.0               |
| 8.5            | <b>Median</b> | <b>1.4</b>    | <b>0.05</b>         | <b>3.70</b>     | <b>0.02</b>     | <b>6.30</b>      |                   |
| 9              | 18-May-94     | 1.5           | 0.04                | 3.70            | 0.02            | 1.30             | 0.0               |
| <b>Median</b>  |               | <b>1.0</b>    | <b>0.06</b>         | <b>2.40</b>     | <b>0.06</b>     | <b>5.00</b>      | <b>10.2</b>       |
| <b>Maximum</b> |               | <b>1.5</b>    | <b>0.16</b>         | <b>3.70</b>     | <b>0.14</b>     | <b>16.10</b>     | <b>31.6</b>       |
| <b>Minimum</b> |               | <b>0.6</b>    | <b>0.03</b>         | <b>0.30</b>     | <b>0.01</b>     | <b>1.20</b>      | <b>0.0</b>        |

Note: High chlorophyll levels are highlighted in red.

Attached below are graphs taken from Lucey *et al.*, 1999 showing phosphorous and nitrogen loadings from rivers in Ireland as discussed in the main report. Summary data from EPA surveys in Youghal Harbour (Lucey *et al.*, 1999) is also included.

**Blackwater (Munster) Estuary and Youghal Harbour**

Surveyed by EPA on 2 dates; 0 Winter and 2 Summer  
(12 June and 31 July 1997)

Analytical Laboratory: EPA Regional Inspectorate, Pottery Road, Dún Laoghaire

Area Surveyed: Freshwater limits of Blackwater and Tributaries to Youghal Bay (Ram Head - Knockadoon Head)  
Estuarine-Coastal Boundary: Youghal - East Point

| Salinity<br>psu | Temp<br>°C | pH | Secchi Depth<br>metres | DO %<br>Saturation | BOD <sub>5</sub><br>mg/l | TON<br>mg/l N | NH <sub>3</sub> + NH <sub>4</sub><br>mg/l N | Un-ionised<br>NH <sub>3</sub> mg/l N | MRP<br>mg/l P | DIN : DIP<br>Ratio | Chlorophyll a<br>mg/m <sup>3</sup> |
|-----------------|------------|----|------------------------|--------------------|--------------------------|---------------|---|--------------------------------------|---------------|--------------------|------------------------------------|
|-----------------|------------|----|------------------------|--------------------|--------------------------|---------------|---|--------------------------------------|---------------|--------------------|------------------------------------|

**Blackwater (Munster) Estuary and Tributaries to Youghal - East Point**

|        |         |      |      |     |     |     |     |       |       |        |       |       |       |
|--------|---------|------|------|-----|-----|-----|-----|-------|-------|--------|-------|-------|-------|
| Winter | n       | 0    | 0    | 0   | 0   | 0   | 0   | 0     | 0     | 0      | 0     | 0     |       |
|        | Minimum |      |      |     |     |     |     |       |       |        |       |       |       |
|        | Median  |      |      |     |     |     |     |       |       |        |       |       |       |
|        | Maximum |      |      |     |     |     |     |       |       |        |       |       |       |
| Summer | n       | 136  | 136  | 28  | 26  | 14  | 28  | 28    | 28    | 28     | 28    | 25    |       |
|        | Minimum | 0.0  | 13.5 | 7.6 | 0.4 | 73  | 1.1 | 0.108 | 0.001 | 0.0000 | 0.001 | 31.9  | 4.43  |
|        | Median  | 12.3 | 16.0 | 8.0 | 1.0 | 89  | 1.4 | 1.788 | 0.041 | 0.0013 | 0.043 | 87.7  | 18.95 |
|        | Maximum | 34.5 | 18.7 | 8.2 | 2.5 | 108 | 2.2 | 2.616 | 0.108 | 0.0024 | 0.087 | 241.0 | 53.61 |

**Youghal Harbour (Youghal - East Point) to Inner Youghal Bay (51° 54.72' N; 007° 50.29' W)**

|        |         |      |      |     |     |    |   |       |       |        |       |       |       |
|--------|---------|------|------|-----|-----|----|---|-------|-------|--------|-------|-------|-------|
| Winter | n       | 0    | 0    | 0   | 0   | 0  | 0 | 0     | 0     | 0      | 0     | 0     |       |
|        | Minimum |      |      |     |     |    |   |       |       |        |       |       |       |
|        | Median  |      |      |     |     |    |   |       |       |        |       |       |       |
|        | Maximum |      |      |     |     |    |   |       |       |        |       |       |       |
| Summer | n       | 20   | 20   | 4   | 3   | 4  | 0 | 4     | 4     | 4      | 4     | 4     |       |
|        | Minimum | 31.5 | 13.0 | 8.0 | 1.5 | 96 | 0 | 0.145 | 0.001 | 0.0000 | 0.001 | 43.5  | 4.03  |
|        | Median  | 33.8 | 14.7 | 8.1 | 2.5 | 97 | 0 | 0.196 | 0.008 | 0.0003 | 0.005 | 252.1 | 6.45  |
|        | Maximum | 35.5 | 15.0 | 8.1 | 3.4 | 98 | 0 | 0.267 | 0.024 | 0.0008 | 0.010 | 592.5 | 16.12 |

IV-7

0.018

0.006

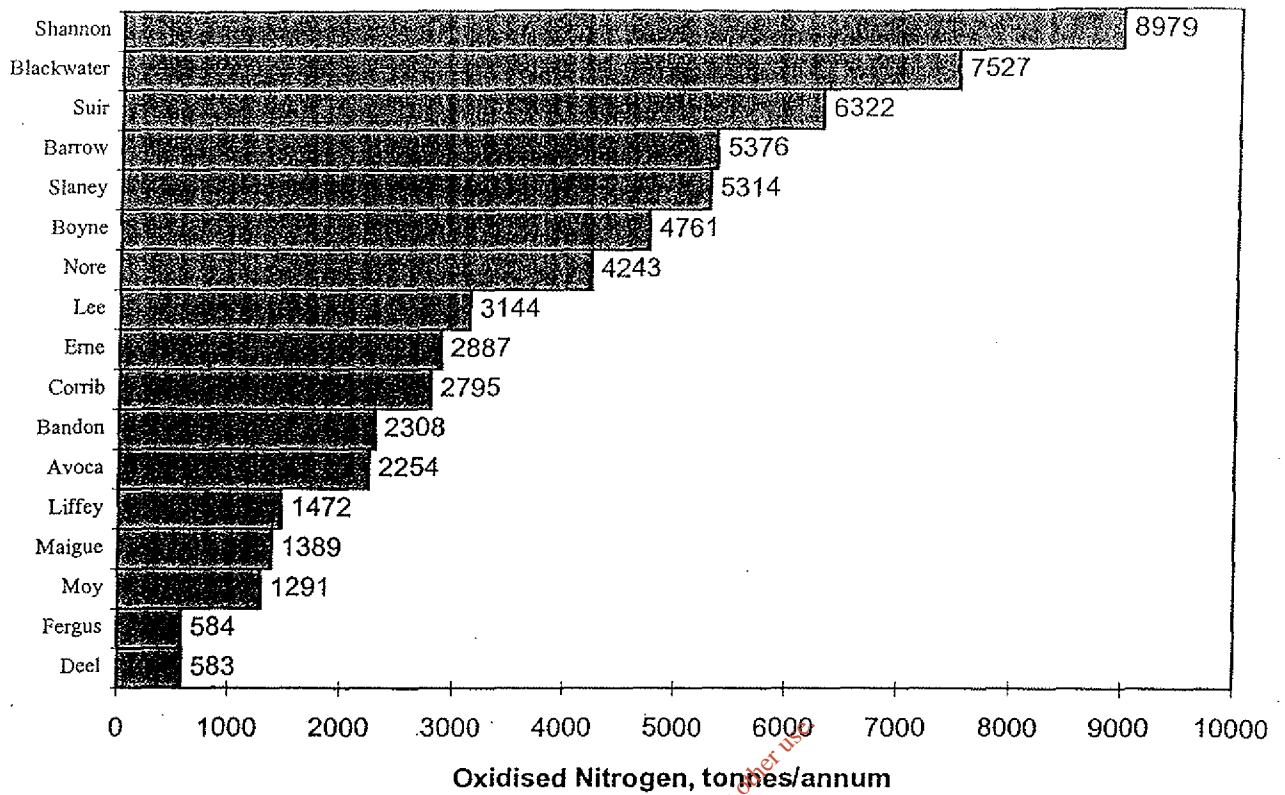


Fig. 2.10 Mean annual Oxidised Nitrogen loads at the freshwater limits of the rivers included in the OSPAR Riverine Inputs Study, based on measurements made in the period 1990-1997

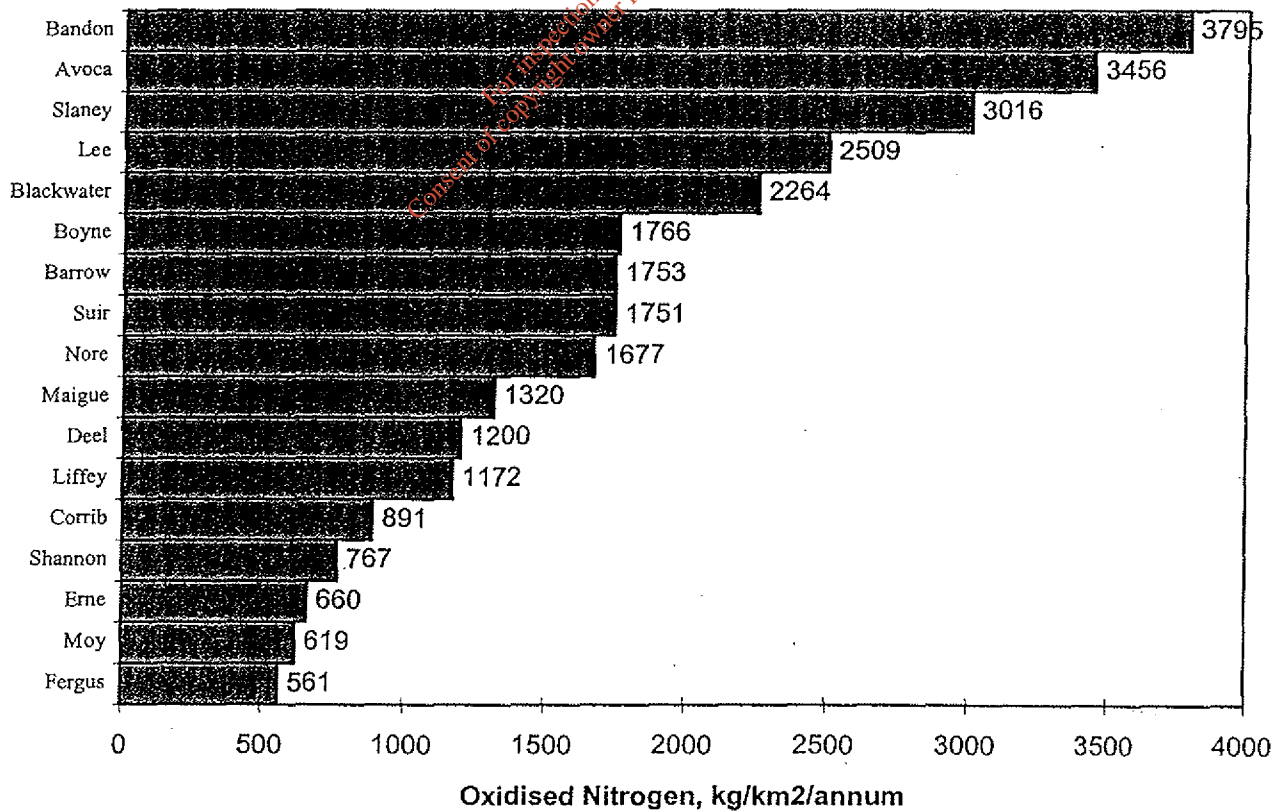


Fig. 2.11 Mean annual catchment export rates of Oxidised Nitrogen at the freshwater limits of the rivers included in the OSPAR Riverine Inputs Study, based on measurements made in the period 1990-1997

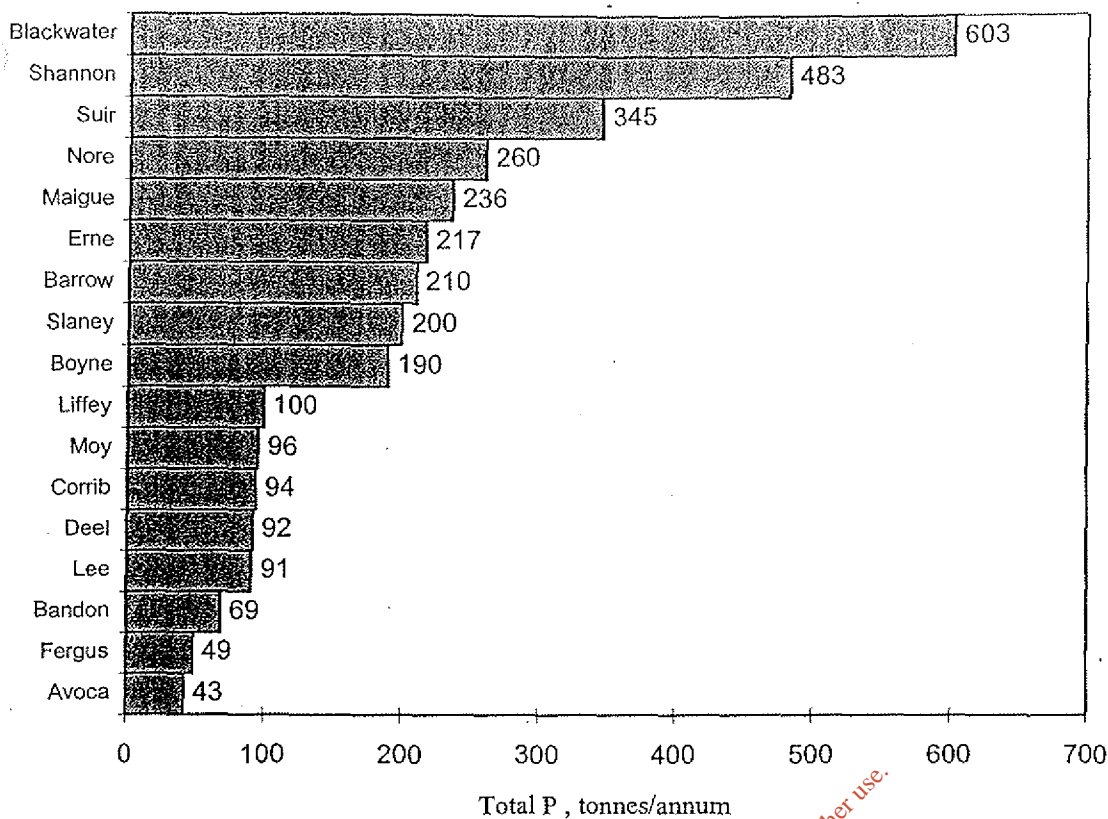


Fig. 2.8 Mean annual total phosphorus loads at the freshwater limits of the rivers included in the OSPAR Riverine Inputs Study, based on measurements made in the period 1990-1997

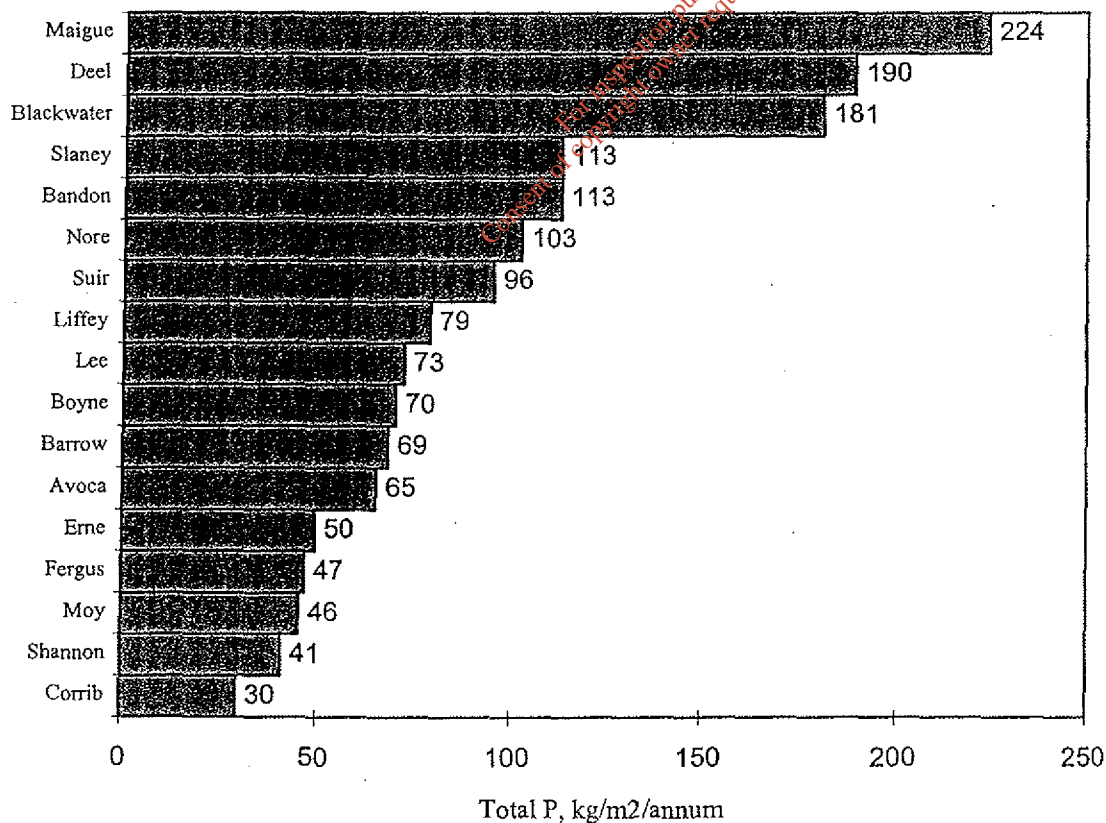


Fig. 2.9 Mean annual catchment export rates of total phosphorus at the freshwater limits of the rivers included in the OSPAR Riverine Inputs Study, based on measurements made in the period 1990-1997