Appendix 14. Surface Water

14.1. Classification Criteria (Transitional Water Bodies)

Table 14.1: General WFD Status Definitions

Status	General Definition
High status	There are no, or only very minor, anthropogenic alterations to the values of the physio-chemical and hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions. The values of the biological quality elements for the surface water body reflect those normally associated with that type under undisturbed conditions, and show no, or only very minor, evidence of distortion.
Good status	The values of the biological quality elements for the surface water body type show low levels of distortion resulting from human activity but deviate only slightly from those normally associated with the surface water body type under undisturbed conditions.
Moderate status	The values of the biological quality elements for the surface water body type deviate moderately from those normally associated with the surface water body type under undisturbed conditions. The values show moderate signs of distortion resulting from human activity and are significantly more disturbed than under conditions of good status.

Source: *European Communities Environmental Objectives (Surface Waters) Regulations, 2009* (S.I. 272 of 2009)

Table 14.2: General Conditions (ecological)

Condition	Transitional Water Body
Thermal (Temperature)	Not greater than 1.5°C rise in temperature outside of the mixing zone
Oxygenation (Biological Oxygen Demand mgO2/l)	≤4.0 mg/l (95 %ile)
Oxygenation (Dissolved Oxygen Lower Limit)	(0 psu)(1) 95%ile >70% saturation - Summer (35 psu) 95%ile >80% saturation - Summer
Oxygenation (Dissolved Oxygen Upper Limit)	(0 psu) 95%ile <130% saturation - Summer (35 psu) 95%ile <120% saturation - Summer
Acidification (pH)	Not Applicable
Nutrient (Total Ammonia)	Not Applicable
Nutrient (Dissolved Inorganic Nitrogen (mg N/l))	Not Applicable
Nutrient (Molybdate Reactive Phosphorous (MRP) (mg P/l)	(0-17 psu) ≤0.060 (median) (35 psu) ≤0.040 (median)

Source: *European Communities Environmental Objectives (Surface Waters) Regulations, 2009* (S.I. 272 of 2009)

(1) psu: The Practical Salinity Unit defines salinity in terms of a conductivity ratio of a sample to that of 32.4356g of KCL at 15°C in 1 kg solution. A sample of seawater at 15°C with conductivity equal to this KCL solution has a salinity of exactly 35 practical salinity.

Table 14.3: Specific Pollutants (Ecological)

Name of Substance	Environmental Quality Standard (EQS)	
	AA-EQS	MAC-EQS
Arsenic	20	-
Chromium III	-	-
Chromium VI	0.6	32
Copper	5	-
Cyanide	10	-
Diazinon	0.01	0.26
Dimethoate	0.8	4
Fluoride	1,500	-
Glyphosate	-	-
Linuron	0.7	0.7
Mancozeb	2	7.3
Monochlorobenzene	25	-
Phenol	8	46
Toluene	10	-
Xylenes	10	-
Zinc	40	-

Source: *European Communities Environmental Objectives (Surface Waters) Regulations, 2009* (S.I. 272 of 2009)

AA: Annual Average

MAC: Maximum Allowable Concentration

Unit (µg/l)

Table 14.4: Priority Substances (Chemical)

Number	Name of Substance	AA EQS	MAC-EQS
(1)	Alachlor	0.3	0.7
(2)	Atrazine	0.6	2.0
(3)	Benzene	8	50
(4)	Carbon-tetrachloride	12	Not Applicable
(5)	Chlorfenvinphos	0.1	0.3
(6)	Chlorpyrifos (Chlorpyrifos-ethyl)	0.03	0.1
(7a)	Cyclodiene pesticides: Aldrin Dieldrin Endrin Isodrin	Σ=0.005	Not Applicable
(7b)	DDT total	0.025	Not Applicable
	para-para-DDT	0.01	Not Applicable
(8)	1,2-Dichloroethane	10	Not Applicable
(9)	Dichloromethane	20	Not Applicable
(10)	Di(2-ethylhexyl)-phthalate (DEHP)	1.3	Not Applicable
(11)	Diuron	0.2	1.8
(12)	Fluoranthene	0.1	1
(13)	Isoproturon	0.3	1.0
(14)	Lead and its compounds	7.2	Not Applicable
(15)	Naphthalene	1.2	Not Applicable
(16)	Nickel and its compounds	20	Not Applicable
(17)	Octylphenol ((4-(1,1',3,3'-tetramethylbutyl)-phenol))	0.01	Not Applicable
(18)	Pentachloro-phenol	0.4	1
(19)	Simazine	1	4
(20a)	Tetrachloro-ethylene	10	Not Applicable
(20b)	Trichloro-ethylene	10	Not Applicable
(21)	Trichloro-benzenes	0.4	Not Applicable
(22)	Trichloro-methane	2.5	Not Applicable
(23)	Trifluralin	0.03	Not Applicable

Source: *European Communities Environmental Objectives (Surface Waters) Regulations, 2009* (S.I. 272 of 2009)

Table 14.5: Priority Hazardous Substances (Chemical)

Number	Name of Substance	AA EQS	MAC-EQS
(1)	Anthracene	0.01	0.05
(2)	Brominated diphenylether	0.1	0.6
(3)	Cadmium and its compounds (depending on water hardness classes)	0.002	0.02
(4)	C10-13 Chloroalkanes	0.05	0.07
(5)	Endosulfan	0.3	2.0
(6)	Hexachloro-benzene	0.0007	Not Applicable
(7)	Hexachloro-butadiene	Not Applicable	Not Applicable
(8)	Hexachloro-cyclohexane	0.05	0.1
(9)	Mercury and its compounds	Σ=0.03	Not Applicable
(10)	Nonylphenol (4-Nonylphenol)		
(11)	Pentachloro-benzene	Σ=0.002	Not Applicable
(12)	Polyaromatic hydrocarbons (PAH)		
	Benzo(a)pyrene	0.0002	0.0015
	Benzo(b)fluor-anthene		
	Benzo(k)fluor-anthene		
	Benzo(g,h,i)-perylene		
	Indeno(1,2,3-cd)-pyrene		
(13)	Tributyltin compounds (Tributhyltin-cation)		

Source: *European Communities Environmental Objectives (Surface Waters) Regulations, 2009* (S.I. 272 of 2009)

14.2. Full Report for Waterbody Barrow Suir Nore Estuary

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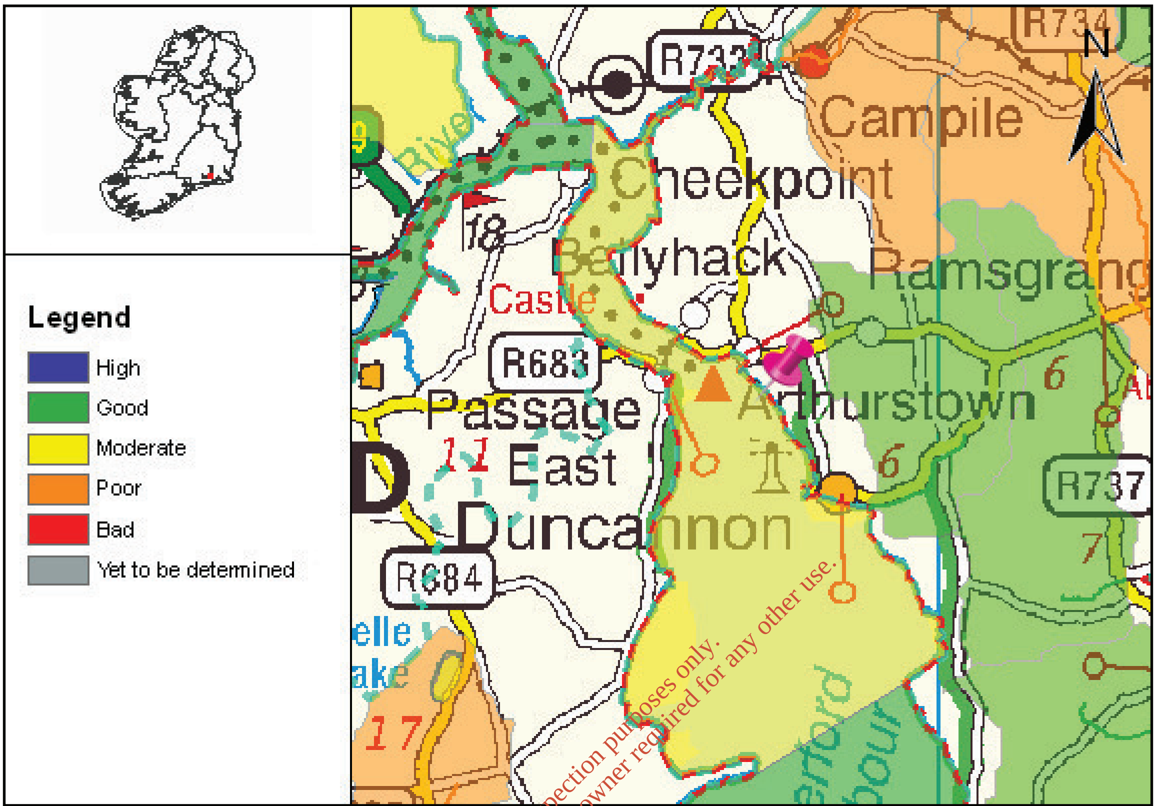
Full Report for Waterbody Barrow Suir Nore Estuary



Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Summary Information:

WaterBody Category:	Transitional Waterbody
WaterBody Name:	Barrow Suir Nore Estuary
WaterBody Code:	IE_SE_100_0100
Overall Status:	Moderate
Overall Objective:	Restore
Overall Risk:	1a At Risk
Applicable Supplementary Measures:	Urban & Industrial;

south eastern river basin district

Report data based upon Draft RBMP, 22/12/2008.

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Status Report

WaterBody Category: Transitional Waterbody

WaterBody Name: Barrow Suir Nore Estuary

WaterBody Code: IE_SE_100_0100

Overall Status Result: Moderate

south eastern river basin district

	Status Element Description	Result
EX	Status from Monitored or Extrapolated Waterbody	True
	General Conditions	
DIN	Dissolved Inorganic Nitrogen	Moderate
MRP	Molybdate Reactive Phosphorus	High
DO	Dissolved Oxygen as percent saturation	High
BOD	Biochemical Oxygen Demand	Good
T	Temperature	Pass
	Biological Elements	
PB	Phytoplankton - Phytoblooms	
PBC	Phytoplankton - PhytoBiomass (Chlorophyll)	Good
MA	Macroalgae	
RSL	Reduced Species List	
SG	Angiosperms - Seagrass and Saltmarsh	
BE	Benthic Invertebrates	
FI	Fish	Good
	HydroMorphology	
HY	Hydrology	
MO	Morphology	Good
	Specific Pollutants	
SP	Specific Relevant Pollutants (Annex VII)	Pass
	Conservation Status	
CN	Conservation Status (Expert Judgement)	Good
	Protected Area Status	
PA	Overall Protected Area Status	At least good

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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	Overall Status	
ES	Ecological Status	Good
CS	Chemical Status	Fail
O	Overall Ecological Status	Moderate

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Risk Report

WaterBody Category: Transitional Waterbody

WaterBody Name: Barrow Suir Nore Estuary

WaterBody Code: IE_SE_100_0100

Overall Risk Result: 1a At Risk

south eastern river basin district

	Risk Test Description	Risk
	Point Risk Sources	
TP1	WWTPs (2008)	1a At Risk
TP2	CSOs	2b Not At Risk
TP3	IPPCs (2008)	1a At Risk
TP4	Section 4s (2008)	2b Not At Risk
TPO	Overall Risk from Point Sources - Worst Case (2008)	1a At Risk
	Hydrology	
THY1	Water balance - Abstraction	2b Not At Risk
	Marine Direct Impacts	
TMDI 1	Dangerous Substances	1b Probably At Risk
TMDI 2	OSPAR	
TMDI 3	UWWT Regs Designations	
TMDI O	Marine Direct Impacts Overall - Worst Case	
	Point / MDI Worst Case	
TPOL	Worst case of Point Overall and MDI OverallOverall (MIMAS) Morphological Risk - Worst Case (2008)	1a At Risk
	Overall Risk	
RA	Transitional Overall - Worst CaseOverall (MIMAS) Morphological Risk - Worst Case (2008)	1a At Risk

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Objectives Report

WaterBody Category:	Transitional Waterbody
WaterBody Name:	Barrow Suir Nore Estuary
WaterBody Code:	IE_SE_100_0100
Overall Objective:	Restore

south eastern river basin district

	Objectives Description	Result
	Objectives	
OB1	Objective 1 - Protected Areas	Restore
OB2	Objective 2 - Protect High and Good Status	Not Applicable
OB3	Objective 3 - Restore Less Than Good Status	Not Applicable
OB4	Objective 4 - Reduce Chemical Pollution	Restore
OBO	Overall Objective	Restore
	Deadline	
YR	Default Year by which the objective must be met	2015
OBO	Overall Objective and Deadline	Restore - 2015

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Basic Measures Report

WaterBody Category: Transitional Waterbody

WaterBody Name: Barrow Suir Nore Estuary

WaterBody Code: IE_SE_100_0100

south eastern river basin district

	Basic Measures Description	**Applicable**
	Key Directives	
BA	Bathing Waters Directive	Yes
BI	Birds Directive	No
HA	Habitats Directive	Yes
DW	Drinking Waters Directive	No
SEV	Major Accidents and Emergencies (Seveso) Directive	Yes
EIA	Environmental Impact Assessment Directive	Yes
SE	Sewage Sludge Directive	Yes
UW	Urban Waste Water Treatment Directive	No
UW	Urban Waste Water Treatment Directive	No
PL	Plant Protection Products Directive	Yes
NI	Nitrates Directive	Yes
IP	Integrated Pollution Prevention Control Directive	Yes
	Other Stipulated Measures	
CR	Cost recovery for water use	Yes
SU	Promotion of efficient and sustainable water use	No
DWS	Protection of drinking water sources	No
AB	Control of abstraction and impoundments	No
PT	Control of point source discharges	Yes
DI	Control of diffuse source discharges	Yes
GWD	Authorisation of discharges to groundwater	No
PS	Control of priority substances	Yes
MOR	Control of physical modifications to surface waters	Yes
OA	Controls on other activities impacting on water status	Yes
AP	Prevention or reduction of the impact of accidental pollution incidents	Yes

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

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Urban and Industrial Discharges Supplementary Measures Report

WaterBody Category: Transitional Waterbody

WaterBody Name: Barrow Suir Nore Estuary

WaterBody Code: IE_SE_100_0100

south eastern river basin district

	Point discharges to waters from municipal and industrial sources	Result
PINDDIS	Is there one or more industrial discharge (Section 4 licence issued by the local authority or IPPC licence issued by the EPA) contained within the water body?	Yes
PINDDISR	Are there industrial discharges (Section 4 licence issued by the local authority or IPPC licence issued by the EPA) that cause the receiving water to be 'At Risk' within the water body?	Yes
PB1	Basic Measure 1 - Measures for improved management.	Yes
PB2	Basic Measure 2 - Optimise the performance of the waste water treatment plant by the implementation of a performance management system.	No
PB3	Basic Measure 3 - Revise existing Section 4 license conditions and reduce allowable pollution load.	Yes
PB4	Basic Measure 4 - Review existing IPPC license conditions and reduce allowable pollution load.	Yes
PB5	Basic Measure 5 - Investigate contributions to the collection system from unlicensed discharges.	Yes
PB6	Basic Measure 6 - Investigate contributions to the collection system of specific substances known to impact ecological status.	Yes
PB7	Basic Measure 7 - Upgrade WWTP to increase capacity.	Yes
PB8	Basic Measure 8 - Upgrade WWTP to provide nutrient removal treatment.	Yes
PS1	Supplementary Measure 1 - Measures intended to reduce loading to the treatment plant.	Yes
PS2	Supplementary Measure 2 - Impose development controls where there is, or is likely to be in the future, insufficient capacity at treatment plants.	Yes
PS3	Supplementary Measure 3 - Initiate investigations into characteristics of treated wastewater for parameters not presently required to be monitored under the urban wastewater treatment directive.	No
PS4	Supplementary Measure 4 - Initiate research to verify risk assessment results and determine the impact of the discharge.	Yes
PS5	Supplementary Measure 5 - Use decision making tools in point source discharge management.	Yes
PS6	Supplementary Measure 6 - Install secondary treatment at plants where this level of treatment is not required under the urban wastewater treatment directive.	No
PS7	Supplementary Measure 7 - Apply a higher standard of treatment (stricter emission controls) where necessary.	Yes

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PS8	Supplementary Measure 8 - Upgrade the plant to remove specific substances known to impact on water quality status.	No
PS9	Supplementary Measure 9 - Install ultra-violet or similar type treatment.	No
PS10	Supplementary Measure 10 - Relocate the point of discharge.	Yes

Date Reported to Europe: 22/12/2008

Date Report Created 08/11/2009

14.3. Flood Risk Assessment



Proposed Power Plant at Great Island Co. Wexford

Flood Risk Assessment

October 2009
Endesa Ireland Ltd.

Mott MacDonald

Proposed Power Plant at Great Island Co. Wexford

Flood Risk Assessment

October 2009

Endesa Ireland Ltd.

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	27/10/09	DMUR	PDOY	PKEL	Initial Issue

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Content

List of Tables

1. Introduction

1.1 Introduction

Endesa Ireland Limited (Endesa) commissioned Environmental Resources Management (ERM) and Mott MacDonald Ireland Limited (MM) to prepare an Environmental Impact Statement (EIS) and planning application for the proposed construction of a Combined Cycle Gas Turbine (CCGT) power plant. The project is wholly privately owned and financed by Endesa Ireland Ltd. The proposed development site is located in the townland of Great Island, Co. Wexford, (OS Grid Reference: E268907 N114574). Refer to Figure 1.1 Site Location. This report was prepared as part of the EIS process and evaluates the potential flood risk for the proposed development with regard to the Draft Guidelines *"The Planning System and Flood Risk Management"* and outlines mitigation measures including a drainage strategy in accordance with the *Greater Dublin Strategic Drainage Study (GDSDS)*.

1.2 Background Information

A CCGT power plant works on the principle of optimum electricity generating efficiency. In a CCGT plant, a gas turbine generator generates electricity and the waste heat from the gas turbine is used to make steam to generate additional electricity via a Heat Recovery Steam Generator (HRSG) and a Steam Turbine Generator (STG). Depleted steam from the steam turbine is condensed back to water and fed back to the boiler. Any hot gases remaining from the process are emitted to atmosphere via an exhaust gas stack.

The proposed plant will utilise the existing cooling water intake and outlet systems to condense steam for use in the HRSG. High purity feed water, for use within the HRSG, will also be required. This water will be sourced from the mains supply.

Electrical power from the new plant will be exported from the existing 220 kV switchyard on site via existing overhead lines onto the regulated electricity market.

Natural gas, supplied from the Bord Gáis Networks (BGN) grid, will be the primary fuel source for the facility. To comply with the requirements of the Commission for Energy Regulation (CER) a stock of distillate oil will be stored on site, in sufficient capacity to run the plant for five days in the event of an interruption to the natural gas supply.

1.3 Existing Site Description

There is an existing power plant at Great Island which currently operates on Heavy Fuel Oil (HFO) with a maximum electrical output capacity of 240 MW. The existing plant comprises three units, two 60 MW units and one 120 MW unit. All of the existing units are at the end of their life span. The Great Island power plant occupies an area of approximately 58 hectares (143 acres). Only part of the 58 hectare site will be required to construct the proposed new CCGT. The area where the new plant is proposed is a brownfield site, which for the most part (approximately 85%), is unused and clear of structures and services. Existing structures and services within the proposed construction area include storage buildings, a number of tanks, a sewage treatment plant and a number of sewer pipes.

Notes

1. ORDNANCE SURVEY IRELAND LICENCE NO. EN0034509
© ORDNANCE SURVEY IRELAND/GOVERNMENT OF IRELAND
2. ALL CO-ORDINATES SHOWN RELATE TO IRISH NATIONAL GRID CO-ORDINATES.
3. ALL SITE LEVELS REFER TO MEAN SEA LEVEL VERTICAL DATUM AT POOLBEG.
4. GENERAL SITE LEVEL IS +7.00M O.D.

Site Boundary
Property Boundary

1:10000 0 500m 1000m

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	02/11/09	SK	For Information Only	DH	PK

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Mott MacDonald Ireland Ltd.
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Title

Combined Cycle Gas Turbine (CCGT)
Great Island, Co. Wexford

Site Location Plan

Designed	.	Eng.Chk.	.
Drawn	S Kennedy	Coordination	D Hassett
Dwg.Chk.	D Hassett	Approved	P Kelly
Scale 1:10000	Project 257554	CAD file Figure 1.1	Status INF
Drawing No Figure 1.1			Rev P1

1.4 Proposed Site Description

Endesa proposes to construct a natural gas fired CCGT power plant with an electrical output capacity of 430 MW. The development site is brownfield and located within the confines of the existing operational power plant facility, formerly operated by ESB. The proposed development site will occupy approximately 8 hectares (19 acres).

The development will include construction of site drainage systems as shown on Drawing 25755401C011 – Site Drainage Plan contained in Appendix A.

2. Initial Flood Risk Assessment

2.1 Possible Flooding Mechanisms

Sources of flooding can vary depending on a number of aspects, including site location, ground conditions, extent and type of development. Typical sources of flood risk are listed in Table 2.1 below and whether or not they are deemed significant for the proposed site at Great Island.

Table 2.1: Significance of Possible Flooding Mechanisms

Source/Pathway	Significant?	Comment/Reason
Tidal/Coastal	Yes	The Suir/Barrow Estuary is affected by the tides
Fluvial	Yes	Suir/Barrow Estuary
Pluvial (urban drainage)	Yes	On site runoff. Tide locking
Groundwater	-	See note below
Overland flow	No	Surrounding area is controlled by site owner. Detailed drainage design will allow for any overland flow
Blockage	No	Negligible with regular maintenance
Infrastructure failure	No	Negligible with regular maintenance
Rainfall Ponding	No	Re-profiling proposed for site so that it will be flat with no depressed areas

Note: *No site specific geotechnical investigations have been carried out to date so assessment of groundwater as a flood risk is not possible at this stage. It is recommended that this is assessed further at detailed design stage. It is likely that ground water levels will be largely influenced by the water level in the estuary. This means that flood risk associated with groundwater is likely to be low at this location.*

Based on available information, there are two significant sources of flood risk evident – the Suir / Barrow Estuary, which is tidal at this point due to its proximity to the sea, and surface water runoff due to rainfall. It is necessary to estimate the level of risk to the proposed development associated with these sources.

The first notable risk is from the estuary which roughly borders the south, and west of the proposed development location at Great Island. The existing site does not have significant flood defences such as elevated embankments or a flood defence berm. This report will consider the possibility of inundation at the site due to high water levels in the estuary during extreme events such as simultaneous surge and high spring tide.

The proposed development will increase the impermeable area of the existing site and hence surface water runoff from the site will be increased. This presents a risk of pluvial flooding on site and an increase in the surface water discharges to the estuary. Consideration will need to be given to the existing surface water runoff route and the drainage characteristics in order to evaluate the impact that surface water runoff from the site will have on the proposed site itself and on other sites downstream of the discharge point. The possibility of flooding due to tide locking will also be considered under the pluvial heading.

2.2 Coastal & Fluvial Flood Risk: The Suir / Barrow Estuary

2.2.1 Key Points

At the outset of this section it is important to set out a number of key points, the first of which is in relation to the datum for site level references. Coastal and tidal level information is often given in relation to local Chart Datum. At Great Island available Admiralty Charts and predicted tide information all reference Chart as opposed to the OSI's Poolbeg Datum or Malin which since the 1980's is the current datum for land levelling in Ireland. It should be noted that Chart Datum varies depending on location along the Estuary but at Great Island, 0m Chart Datum is the same as 0m Poolbeg Datum. Poolbeg Datum is approximately 2.71m below Malin Datum. All references to levels in this section will be in metres above Poolbeg Datum (ODP). Existing levels at the location of the proposed site are in the range 6.4m to 7.3m ODP and the proposed finished ground level will be 7.0m ODP with a finished floor level of 7.2m ODP.

Secondly, it must be considered that this site is in a very complex area for flood forecasting. It is tidally affected which brings its own degree of uncertainty and is at the confluence of two of Ireland's biggest rivers, the Suir and the Barrow. This study is based on existing, publicly available information.

2.2.2 Available Flooding Information

Admiralty charts indicate that the Mean High Water Spring tide level for the estuary adjacent to the proposed site is 4.3m O.D. Poolbeg.

A search on the OPW National Flood Hazard Mapping website found no record of past flooding within the proposed site area at Great Island. The website is an internet based search for flooding in the area and can be found at: http://www.floodmaps.ie - Grid Reference: S 689 146

However, the OPW flood maps did indicate a recurring flooding event due to a combination of high wind and wave action at Cheekpoint, on the opposite side of the estuary, due south of the proposed development site.

The OPW website also included a report which examined flooding at Scotch Quay in Waterford City, approximately 10km upstream (River Suir) from the proposed site. This report dated October 1999, stated that the highest ever recorded tide is 5.69m O.D. Poolbeg. The report also included results from analysis by H.R. Wallingford of 33 years worth of data recorded at Great Island. The results included predicted tide levels at Great Island for events with a range of return periods (or probabilities), this table is reproduced below:

Table 2.2: Tide Level for Various Return Periods

Return Period (1 in x Years)	Tide Level (mO.D. Poolbeg)
2	4.91
5	5.09
10	5.21
25	5.36
50	5.48
100	5.59
200	5.71

This data is particularly useful in that it uses actual data recorded at Great Island and includes the effects of tides, surges and river flows. However, as it is based on only 33 years data, extrapolation to return periods of 50 years and beyond needs to be treated with a degree of caution.

The OPW flood maps also indicated areas denoted as "Land Commission" and "Drainage District" which do not cover the proposed or existing power station but are located immediately east of the proposed development site. The glossary for the website offers the following definition for areas denoted under Land Commission and Drainage District;

Maps indicating areas of land defended to some degree against flooding that were formerly the responsibility of the Land Commission.

A dataset prepared on behalf of the Drainage Districts (Local Authorities with statutory responsibility for maintenance under the Arterial Drainage Act, 1925). These maps identify land that might benefit from the implementation of Arterial (Major) Drainage Schemes and indicate areas of land subject to flooding or poor drainage.

These definitions indicate that flooding has previously been a concern at lands close to the existing and proposed power stations at Great Island but not at the actual site and that flood defence works may have been carried out or considered at these locations in the past.

A report dated 4th of February 2002 available on the OPW website references flooding which occurred on 1st of February 2002 at New Ross and Arthurstown which are upstream and downstream of the proposed site respectively. No flood level information for either location is contained within the report but it states that flooding was the worst in living memory and that the reason for the flooding was a combination of gusts of more than 100km/hr coinciding with the highest predicted tide of 4.53m (Datum Unreferenced). The flooding events of February 2002 on the Suir / Barrow Estuary are not surprising considering it is the same date as one of the most significant coastal flooding events recorded in Ireland occurred.

On 1st February 2002, an extreme tide and flood event caused extensive flooding and disruption at a number of locations on the East coast. The tide level was the highest since records began in Dublin in 1922, being in excess of 1 metre above the predicted tide for that day.

The OPW flood maps website also included a report for a second severe flooding event at Arthurstown, approximately 6km downstream of the site at Great Island. The report is dated 26th of October 2005 and contains water level information which was surveyed on 20th of September 2005 and which was based on accounts of high levels which occurred during flood events which occurred between 27th and 29th of October of the previous year. The levels surveyed are as shown in Table 2.3 below:

Table 2.3: Tide Levels for October 2004 Flood Event at Arthurstown

Reference Spot Location	Top Water Level (mO.D. Poolbeg)	Comment
Corner of stone wall	6.58	TWL = 225mm above tarmac level
Doorstep of dwelling house	5.97	TWL = 75mm above step
Bottom of window sill	6.36	
Wall of house	6.30	TWL confirmed by resident
Road beside gully	5.92	
Road beside lamp stand	5.67	TWL = 25mm above tarmac level
Tarmac beside dropped kerb	6.54	

The levels provided in Table 2.3 should be treated with an element of caution due to the fact that they were surveyed almost a year after the flooding actually occurred. The fact that there is a substantial variation in the figures provided also indicates that the levels may not have been representative of actual tide levels, for example, there could be additional contributing factors such as urban drainage or waves / splashing which may have resulted in an increase in the reported top water levels where surveyed.

In addition to the information mentioned above, the OPW were able to provide water level measurements extending over an approximate 9.5 year period from November 1999 to May 2009 from a tide gauge maintained by the OPW at Adelphi Quay in Waterford City (Hydrometric Station 16160). The highest level reached in the 9.5 years of data is 5.59m O.D. Poolbeg and occurred on the 27th of October 2004. The flood level recorded for the February 2002 event is 5.40m O.D.Poolbeg.

This information provides good agreement that the levels associated with the October 2004 flooding events were the highest in at least the last decade on the Suir Estuary.

Correspondence with Endesa has indicated that the site has no previous history of flooding.

2.2.3 Existing Flood Risk

The Draft Planning Guidelines "*The Planning System and Flood Risk Management*" recommend analysis of flood risk for coastal sites relative to estimates of extreme events such as high tide levels with a probability of occurring once in 200 years or once in 1000 years. These are commonly referred to as the 200 year flood event and the 1000 year flood event. In general, if it is estimated that no flooding will occur for the 1000 year flood, the site is deemed to be low risk. However, it is necessary to obtain and analyse a large amount of historical tide gauge data to produce reliable estimates of extreme high water levels.

Complex analysis of large amounts of tide data is outside the scope of this report which takes a "desktop study" approach based on existing available information. This approach is considered appropriate at the preliminary stage. However, one of the most comprehensive sources of information available at present is from the Scotch Quay report which actually predicts high tide levels up to the 200 year event based on analysis of 33 years worth of data. The existing site where the development is proposed has a finished ground level above the 200 year event level of 5.71m O.D. Poolbeg.

According to this data, the site would be classified as at "Moderate Risk" (at worst) as it is predicted that no flooding would occur on site for the 200 year event. Given the fact that the existing ground level is approximately 1.3m above the 200 year event level, predicted in the Scotch Quay report, it is probable that the site would be considered "Low Risk" but this cannot be proven in the absence of a 1000 year predicted flood level. It should be noted that the definitions of "low" and "moderate" risk are taken from the Draft Guidelines "*The Planning System and Flood Risk Management*". Engineering design for flood risk mitigation would normally be based on applying a factor of safety above the 200 year event and this is the approach taken in Section 3 of this document.

In light of the February 2002 and October 2004 flooding events, it is likely that if the analysis carried out for the Scotch Quay report included this more recent data, the flood risk at the site would have slightly increased over that estimated in 1999.

2.2.4 Increased Future Risk

Studies carried out by the EPA and the OPW and other bodies on climate change indicate that heavy rainfall, river flows and sea level are likely to increase and that surges will become more frequent. Current practice for drainage and flooding design is to make allowances for increased river flows, extreme tide events and sea level rise due to climate change. The Greater Dublin Strategic Drainage Study (Climate Change Policy) recommends design sea level rises of 400-480mm by the end of this century with 1000mm being allowed for key infrastructure or long term planning.

The OPW is the national authority with regard to Flood Risk Assessment. Current OPW practice is to examine two scenarios, a mid-range future scenario and a high-end future scenario. The OPW allowances associated with these scenarios are outlined below;

Table 2.4: Current OPW allowances for climate change

	Mid Range Future Scenario	High End Future Scenario
Extreme Rainfall Depths	+20%	+30%
Flood Flows	+20%	+30%
Mean Sea Level Rise	+500mm	+1000mm
Land Drop	0.5mm/year	0.5mm/year

Note: *Land drop is only applicable to the southern part of the country (Dublin – Galway and south of this).*

It is therefore evident that the minimum sea level rise that should be considered for this study is 500mm.

The OPW are currently carrying out assessment of flood risk along the Irish coast as part of the *Irish Coastal Protection Strategy Study* (ICPSS). The assessment carried out to date includes the location of the existing and proposed power sites at Great Island. Although the OPW do not permit use of the data as a reliable source, as it is unpublished and therefore subject to validation, they did allow Mott MacDonald to view the data for indicative purposes. The OPW currently predict that flooding will not occur at the Great Island site for either the 200 year event or the 1000 year event. It is important to bear in mind that although the study does include for both tide and surge effects, it does not analyse river flows in detail and does not allow for the effects of climate change.

2.2.5 Coastal and Fluvial Risk Summary

In summary, analysis of 33 years worth of data carried out in 1999 indicated that the proposed site was not likely to flood during a 200 year event and therefore the flood risk would be considered moderate at worst but that it is likely that the site would be classified as low if the 1000 year high tide level was known. This report also mentioned that the highest tide recorded at Scotch Quay in Waterford City was 5.69m O.D. Poolbeg which is lower than the existing ground levels for the Great Island site.

In addition, the most recent reliable measured tide level information available at present is that from the Adelphi Quay gauge maintained by the OPW. This gauge measured a level of 5.4m O.D. Poolbeg at the time of the February 2002 flood events at New Ross and Arthurstown which were described as the worst in living memory at the time of occurrence. The Adelphi gauge also recorded a level of 5.59m O.D. Poolbeg for the flooding events of October 2004 which are considered to have been worse than those which occurred in February 2002. Both extreme events are thought to have occurred due to a combination of high tides and surge effects (low pressure, high winds). The existing site is above the highest levels recorded for these extreme events.

Draft information from the latest OPW study indicates that flooding will not affect the site for the 1 in 200 or 1 in 1000 year events. This information needs to be treated with a degree of caution as it is unpublished and hence yet to be validated data, however, it does give a good indication that risk to the site is low.

As stated above, a degree of caution is required when relying on predicted high tide information. Standard practice is to allow for uncertainty by ensuring that proposed floor levels are at least 500mm higher than predicted flood levels. Standard practice is also to add at least 500mm to predicted high water levels to allow for the affects of climate change. The best available estimate of the 200 year flood level at this site is 5.71m OD Poolbeg. Bearing this information in mind, the minimum finished floor level that could be recommended is 6.71m OD Poolbeg.

The proposed finished floor level for the new plant is 7.2m OD Poolbeg and this is 490mm above the minimum and in fact, allows for more extreme climate change scenarios closer to the 1m sea level rise currently being considered by the OPW for a high end future scenario.

2.3 Pluvial Flood Risk: On Site Drainage

2.3.1 Existing and Proposed Land Use

From a drainage perspective, there are essentially three new collection systems proposed for the development, two for the area where the main CCGT plant is proposed and one for the smaller area where the Above Ground Installation (AGI) is proposed.

The existing site area where the CCGT will be located is approximately 2 hectares (ha), and can be classed as "brown field". There are existing structures in this area such as storage tanks and sheds but it is largely undeveloped. The proposed collection system layout is shown on Drawing 25755401C011 in Appendix A and up to 62% of the site area will be impermeable surfacing (including roofs, structures etc). Tables 2.2 and 2.3 below, list the area coverage by collection network of each land use type across the existing site where the CCGT will be located and also shows the revised land use for the proposed development.

Table 2.5: Land Use Types for the Existing and Proposed CCGT area north (Net. 1)

Land Use Type	Total Land use Area			
	Existing Site		Proposed Development	
	ha	%	ha	%
Built area	0.05	7	0.17	25
Hard standing	0.06	9	0.16	24
Soft landscaping	0.57	84	0.35	51
TOTAL	**0.68**	**100**	**0.68**	**100**

Table 2.6: Land Use Types for the Existing and Proposed CCGT area south (Net. 2)

Land Use Type	Total Land use Area			
	Existing Site		Proposed Development	
	ha	%	ha	%
Built area	1.04	79	0.67	51
Hard standing	0.16	12	0.25	19
Soft landscaping	0.12	9	0.40	30
TOTAL	**1.32**	**100**	**1.32**	**100**

The existing site area where the AGI will be located is approximately 0.16ha, and can also be classed as "brown field". There is an existing oil settlement tank nearby the proposed AGI installation location as well as an existing access road. The proposed collection system layout is shown on Drawing 25755401C011 in Appendix A and up to 50% of the site area will be impermeable surfacing (including roofs, structures etc). Table 2.4 below, lists the area coverage of each land use type across the existing site where the AGI will be located and also shows the revised land use for the proposed development.

Table 2.7: Land Use Types for the Existing and Proposed AGI area (Net. 3)

Land Use Type	Total Land use Area			
	Existing Site		Proposed Development	
	ha	%	ha	%
Built area	0.02	12	0.02	12
Hard standing	0.04	25	0.06	38
Soft landscaping	0.10	63	0.08	50
TOTAL	**0.16**	**100**	**0.16**	**100**

2.3.2 Proposed Drainage System Description

Surface water runoff will consist mostly of storm rainwater but with an allowance for spillage and wash water. Since this may become contaminated with oily substances in some areas, oil interceptors will be included at the downstream ends of proposed collection systems. The bypass oil interceptors will also include silt trap unit which will remove any excess silt or grit which may become entrained in the surface water. Once oils and silts have been removed, surface runoff will be discharged via existing outfalls.

It is proposed that the CCGT area would use two new collection systems to convey water to the existing system and would connect at existing outfalls SW4 and SW12 for discharge to the estuary.

Surface water runoff from the AGI area and its access road will also be conveyed by a new collection system and treated via a silt trap unit and bypass oil interceptor before discharging via the existing Outfall SW1 to the estuary.

2.3.3 Downstream Flood Risk

As outlined above, the new development at Great Island will result in an increase in surface water runoff rates during rainfall events and that discharge rates to watercourses are typically restricted to pre-development rates in order to prevent downstream flooding. However, Section 6.3.4 of the GDSDS states that although its design criteria should apply to all sites in principle, in cases where the consequences of non compliance are minimal, such as draining to an estuary or coast, an intelligent approach should be taken to applying the criteria.

Since discharge from the Great Island site will be to the Barrow Estuary which is approximately 800m wide at this location and which is approximately 17.5km upstream from its confluence point with the Celtic Sea, (a comparatively infinite volume) it is considered that an unrestricted discharge approach may be valid as the increased rate will not be enough to increase flood risk to downstream properties or land. The existing power plant site at Great Island does not have any restriction on surface water discharge rates to the estuary and since the proposed plant is to operate under the same, albeit updated IPPC licence, it is proposed that attenuation will not be required for the proposed new power plant either.

2.3.4 Site Flooding / Pluvial Flood Risk

Although downstream river flood protection criteria do not apply to Great Island, there may be an additional requirement in this area for storage in order to prevent flood risk to the proposed site itself. Standard practice dictates that the surface water collection system will be designed and sized to cater for most rainfall events including prevention of above ground flooding for events with a probability of more than 1 in 30 years (also known as the "return period"). Flooding of designated areas of the site for the events between the 1 in 30 and 1 in 100 year return periods is permissible but must be strictly controlled. The flood risk from the surface water collection system is significantly reduced due to the fact that no discharge limit is proposed and hence the system can generally be designed to discharge surface water to the estuary at the same rate as it is generated on site. However there is an additional risk to be considered at coastal sites due to the possibility of tidelocking.

Tidelocking is the process whereby low lying areas may not be able to drain to the sea or a tidally affected watercourse during high tide conditions. Essentially, during tidelocking, the pressure head in the drainage system is equal to or lower than that in the estuary due to the high tide and hence the surface water is prevented from leaving the collection system. In fact, in the case of a defended site, where the ground levels on site are lower than that of an extreme tide but site inundation is prevented by a defence structure such as a berm, there is risk that water will enter and flood the site through the drainage system. This is generally prevented by the use of flap valves or tideflex valves.

As the volume of water in the collection system increases to a level where the pressure exceeds that exerted by the water pressure in the estuary, the system will be able to discharge a certain amount of surface water until pressure equalises again. This is provided that flap valves are maintained in good working condition. If this is not the case, or if tide locking may occur for long enough to allow rainfall ponding on the site to reach unacceptable levels, then rainfall may need to be stored to prevent flooding. This will depend on the tide levels and the capacity of the drainage system.

The possibility of tide locking will be addressed at detailed design stage. . However, the fact that the proposed ground level at the site is approximately 2.7m above the Mean High Water Spring (MHWS) level and 1.3m above the predicted 200 year event level, it is likely that tidelocking will be overcome by pressure in the collection and discharge system. As long as the discharge valve is regularly maintained, this pressure is likely be the result of minor surcharging of the collection system but not enough to require storage or cause flooding.

3. Mitigation Measures

3.1 Floor levels / Land levels

This preliminary flood risk assessment indicates that the Suir / Barrow Estuary may pose a moderate flood risk to the existing as well as the proposed power generating sites at Great Island. In reality, flood risk is likely to be low but this cannot be proven in the absence of a known 1000 year event level. It is recommended that the proposed finished ground and floor levels are a minimum of 6.71m OD Poolbeg. Increasing this to 7.21m OD would allow for the more extreme climate change scenarios currently being considered. The proposed finished floor level of 7.2m OD is in line with this recommendation.

This report was based on a desktop study only. It relates to a complex area for flood forecasting in that the area is tidally affected and is at the confluence of two of Ireland's biggest rivers. This uncertainty needs to be allowed for by ensuring that all roads and buildings have an adequate degree of freeboard above the predicted high water levels. This issue should be considered further at detailed design stage.

3.2 Emergency Access and Egress

The levels of all potential access routes should be checked to ensure that they will be dry or easily passable, even in extreme flood events.

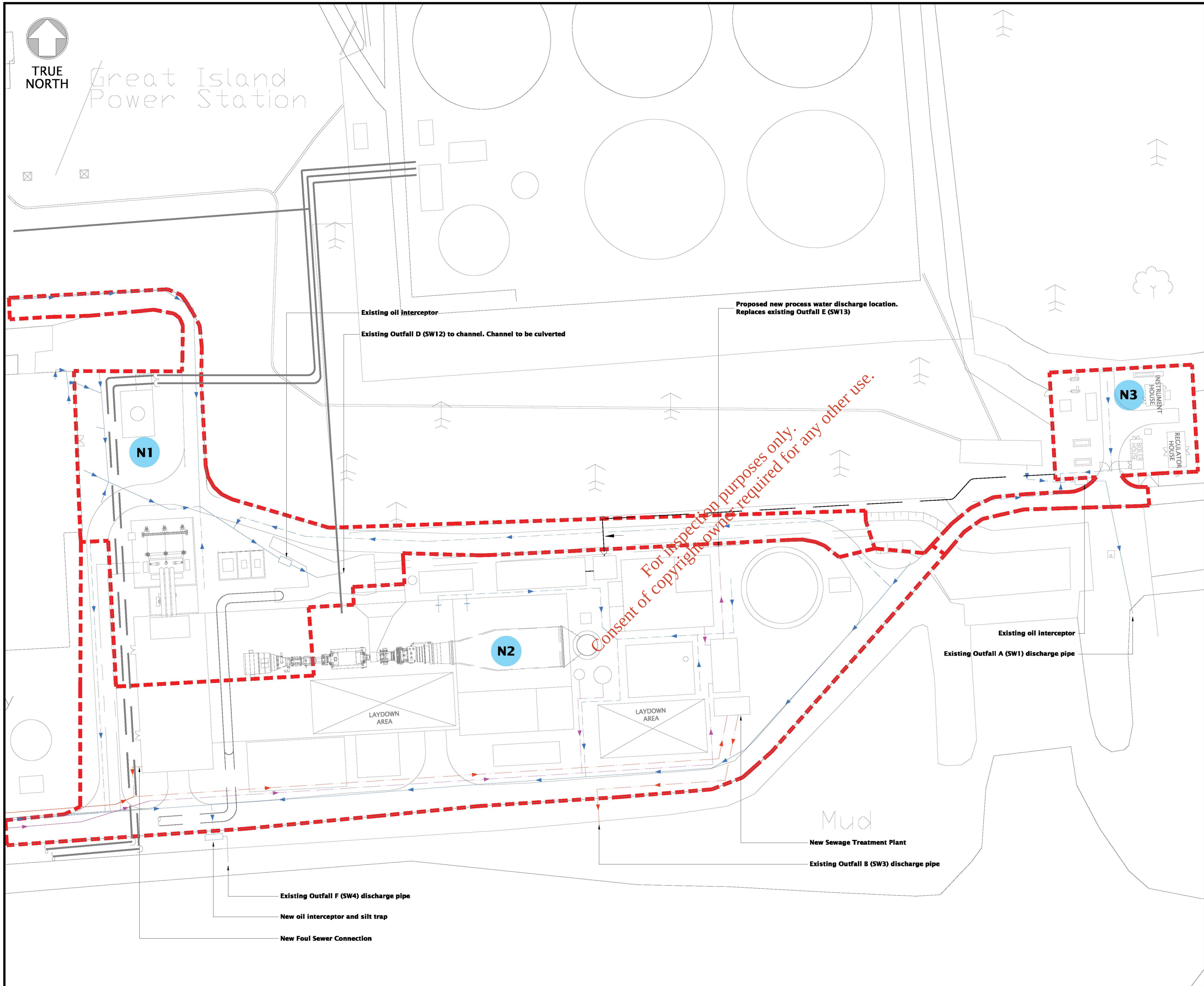
3.3 Surface Water Drainage

Although it is recommended that surface water discharge rates are not restricted at coastal sites and hence attenuation is not required, there is a risk that tidelocking of the drainage systems may cause flooding or that some attenuation allowance may be required to prevent this. The extent of tidelocking cannot be determined for certain until the proposed drainage system is designed in more detail. However, it is thought that due to the proposed ground levels and predicted tides at Great Island, there will not be an attenuation requirement and that there is a low risk of flooding due to tidelocking.

In addition, it is recommended that a survey of the existing drainage system is carried out in order to determine how the existing and proposed collection systems will function when they are combined. This should include surveying of pipe sizes, invert levels, cover levels, pipe sizes, and outfall and valve conditions.

Appendices

Appendix A. Site Drainage Plan



Notes

1. ORDNANCE SURVEY IRELAND LICENCE NO. EN0034509 © ORDNANCE SURVEY IRELAND/GOVERNMENT OF IRELAND
2. ALL CO-ORDINATES SHOWN RELATE TO IRISH NATIONAL GRID CO-ORDINATES.
3. ALL SITE LEVELS REFER TO MEAN SEA LEVEL VERTICAL DATUM AT POOLBEG.
4. GENERAL SITE LEVEL IS +7.00M O.D.
5. THE DRAINAGE LAYOUT SHOWN IS SUBJECT TO CONFIRMATION OF INVERT LEVELS AND CAPACITIES OF THE EXISTING COLLECTION AND OUTFALL PIPES.
6. WHERE POSSIBLE, EXISTING COLLECTION SEWERS AND OUTFALLS WILL BE RE-UTILISED BY ADOPTING THEM INTO THE COLLECTION SYSTEM FOR THE PROPOSED NEW PLANT.
7. FOR CLARITY, ONLY EXISTING SEWERS WHICH ARE PROPOSED TO BE ADOPTED OR ALTERED ARE SHOWN. EXISTING COLLECTION SYSTEMS WHICH WILL NOT BE ALTERED HAVE BEEN OMITTED.
8. TEMPORARY DIVERSION SEWERS MAY BE REQUIRED IN ORDER TO MAINTAIN EXISTING PROCESS AND WASTE FLOWS DURING THE CONSTRUCTION AND PERIOD FOR THE PROPOSED PLANT.

Legend:

Drainage Key.

- Existing Surface Water Drainage
- Proposed Surface Water Drainage
- Existing Foul Drainage
- Proposed Foul Drainage Diversion
- Area Boundary
- Surface Water Drainage Catchment Reference (N)
- Direction of Flow
- Existing Process Water Drainage
- Proposed Process Water Drainage Diversion

0 25m 50m

Scale 1:500

Rev	Date	Drawn	Description	Ch'k'd	App'd
P4	23/10/09	AV	Issued with Planning Application	KMc	DMc
P3	30/09/09	AV	Issued with Planning Application	KMc	DMc
P2	28/08/09	AV	Issued for Approval	KMc	DMc
P1	11/08/09	SK	Issued for Approval	MB	DMc

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Title

Combined Cycle Gas Turbine Great Island, Co. Wexford

Site Drainage Plan

Designed	D. Murphy		Eng.Chk.	M. Bouchouat
Drawn	S.Kennedy		Coordination	K. McGarvey
Dwg.Chk.	K. McCarvey		Approved	D. McRandal

Scale 1:500	Project 257554 CAD file 25755401C004	Status APP
Drawing No 257554/01C/011		Rev P4

Appendix 15. Air Quality and Climate

15.1. Rosslare Meteorological Station

Table 15.1: Rosslare monthly, annual mean and extreme meteorological values from 1961 - 1990

Temperature (oC)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean daily max	8.2	7.9	9.3	10.9	13.2	15.9	17.9	17.9	16.3	13.8	10.6	9.1	12.6
Mean Daily min	3.9	3.8	4.3	5.6	7.9	10.4	12.1	12.2	10.8	9	5.9	4.8	7.6
Absolute max	6.1	5.9	6.8	8.3	10.5	13.2	15	15	13.6	11.4	8.2	7	10.1
Absolute min	12.7	13	14.2	20.1	20.3	25.4	26.2	25.9	21.5	19.2	15.7	14	26.2
Mean no. of days with air frost	-4.4	-4.1	-2.5	-1	-0.3	4.7	5.2	6.2	2.6	0.7	-2.5	-3.1	-4.4
Mean no. of days with air ground frost	2.4	2	1.1	0.3	0	0	0	0	0	0	0.6	1.6	8
Relative Humidity (%)													
Mean at 0900UTC	86	85	84	82	81	82	82	84	84	86	85	86	84
Mean at 1500UTC	81	79	76	76	77	78	77	78	77	80	79	82	78
Sunshine (hours)													
Mean daily duration	1.94	2.47	3.87	5.74	6.88	6.59	6.29	5.86	4.79	3.27	2.5	1.75	4.33
Greatest daily duration	8.2	9.8	11.8	13.4	15.4	15.8	15.9	14	12.8	10.2	8.6	7.3	15.9
Mean no. of days with no sun	11	8	5	3	1	2	1	2	3	6	9	11	61
Rainfall (mm)													
Mean monthly total	94.8	69.9	67.8	55.7	55.8	50.6	50.7	68.7	73.3	94.9	97.1	97.8	877.1
Greatest daily total	44.9	33.4	48.9	27.9	31	32.6	79.1	61	63.6	54.8	56.7	44.8	79.1
Mean no. of days with >=0.22mm	18	15	16	14	14	13	11	13	14	16	16	17	176
Mean no. of days with >=1.0mm	14	11	12	10	10	8	8	9	10	12	13	13	129
Mean no. of days with >=5.0mm	7	5	5	4	4	3	3	4	5	6	6	7	59
Wind (knots)													
Mean monthly speed (m/s)	6.64	6.58	6.38	6.07	5.86	5.20	4.89	5.14	5.50	5.97	6.22	6.58	5.92
Max gust	76	76	66	75	57	51	50	56	72	87	71	80	87
Max. mean 10-minute speed	46	44	42	52	35	38	35	37	47	50	45	50	52
Mean no. of days with gales	2.5	1.5	1.1	1.3	0.3	0.2	0.1	0.2	0.5	0.9	1.3	1.9	11.7
Weather (mean no. of days with…)													
Snow or sleet	2.7	3.7	1.9	0.8	0.1	0	0	0	0	0	0.2	1.3	10.7
Snow lying at 0900UTC	0.8	0.7	0.2	0	0	0	0	0	0	0	0	0.1	1.8
Hail	1.8	1.1	2.5	2.1	1	0.3	0	0	0.1	0.4	1.2	1.2	11.8
Thunder	0.4	0.2	0.1	0.4	0.8	1	1	0.7	0.6	0.5	0.7	0.3	6.7
Fog	2	2.2	3.2	4.2	3.2	4.4	5	4.6	3.9	2.5	1.7	1.6	38.5

15.2. Stack Height Determination

15.2.1. Introduction

This appendix presents a stack height determination undertaken for the proposed plant at Great Island which includes a 430MW Combined Cycle Gas Turbine (CCGT) stack.

The underlying principle of air pollution control is to minimise the release of pollutants to the atmosphere and promote sufficient dispersion and dilution of released pollutants to ensure ground level impacts are not significant.

The first part of this principle is controlling emissions at source through abatement techniques. The second part is the determination of the optimum release conditions, including stack height determination to ensure that subsequent ground level concentrations of the released pollutants remain within acceptable limits.

The objective of the stack height determination is to establish at what stack height local building wake effects are no longer a major constraint thereby ensuring the adequate dispersion of pollutants. The primary determinant of the stack height is therefore the local building heights.

The height of the stacks has been determined by advanced dispersion modelling.

15.2.2. Dispersion Modelling Methodology

On the basis of the above, the stack height determination considers:

- A unit emission rate of 1 g/s enabling the influence of meteorological conditions to be determined;
- All averaging periods relevant to the air quality assessment;
- A range of all likely meteorological conditions through the use of five years (2003-2007) of hourly sequential meteorological data from a representative measuring station (Rosslare Harbour).

Plant emissions characteristics assumed are identical to those reported in the main body of this report (Section 15.7.1.8).

The model has been run using ADMS to determine what stack height is required to overcome local building wake effects. Terrain in the vicinity of the plant is considered likely to affect plume dispersion. Particularly since there are changes in gradient within the site, and hence terrain data have been included in the model. The model was run assuming stack heights between 40m and 100m at 10m incremental spacing. Results were obtained for short term and long term NO_2 averaging periods to this assessment.

The dispersion modelling for the purposes of stack height determination assumed a grid domain of 15km by 15km from the CCGT stack with 200m receptor spacing. Results are reported for the maximum affected location. This is considered a robust and conservative approach.

15.2.3. Results

Modelled results in are ground level concentrations predicted by the model for the CCGT stack. These results illustrate that for stack heights below 50m, local building wake effects are predicted to have a significant influence over dispersion. At stack heights above 60m, local building wake effects are no longer a major constraint for the short and long term averaging period in respect to the air quality standards.

The purpose of the stack height determination is to establish at what stack height local building wake effects are no longer significant, thereby ensuring the adequate dispersion of pollutants. On that basis, a height of 60m is recommended for the proposed plant.

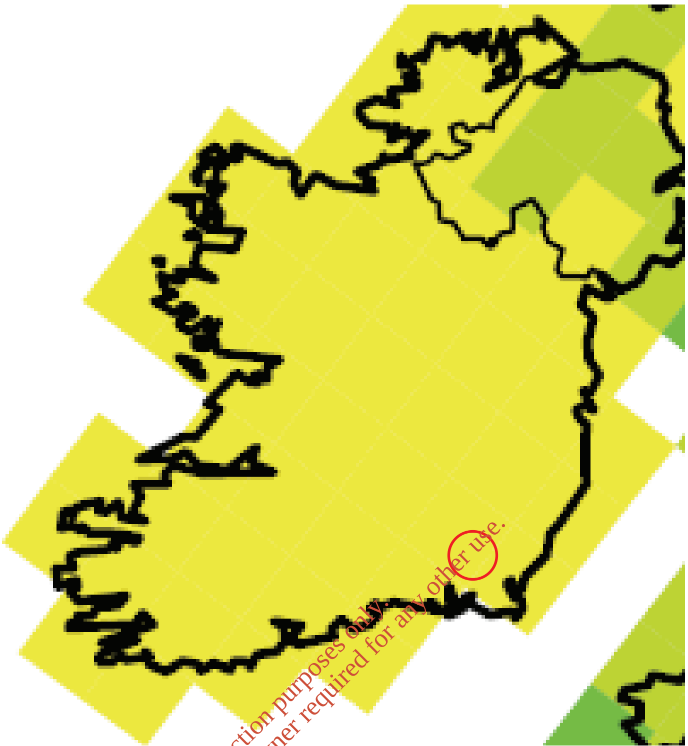
Table 15.2: Stack Height Determination Results

Stack Height (m)	Short Term	Long Term
40	62	7.8
50	27	3.9
60	18	2.2
70	10	1.3
80	9	0.9
90	6	0.8
100	5	0.6

Note: Concentration in $\mu g/m^3$

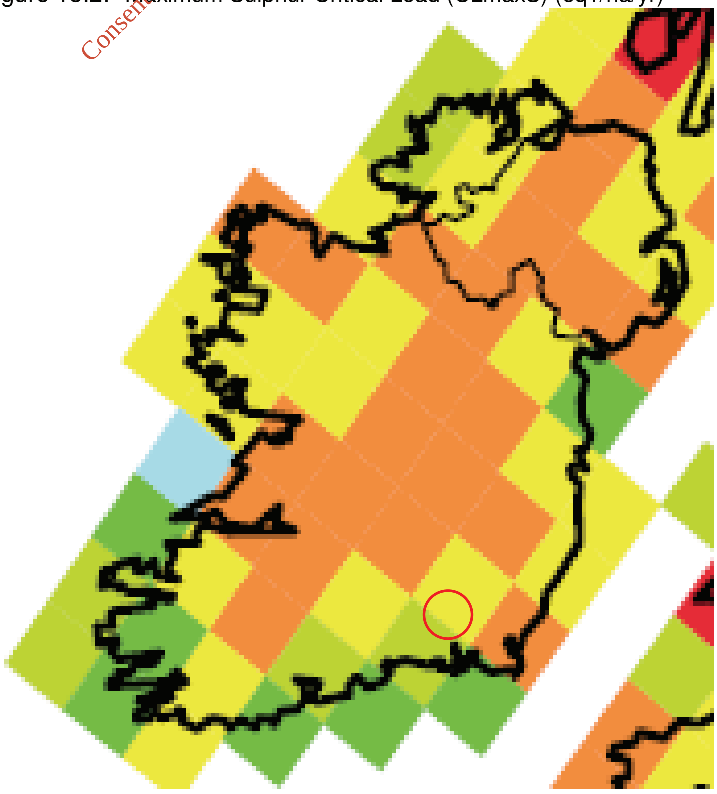
15.3. Critical Load / Deposition Maps

Figure 15.1: Nutrient Nitrogen Critical Load (CLnutN) (eq/ha/yr)



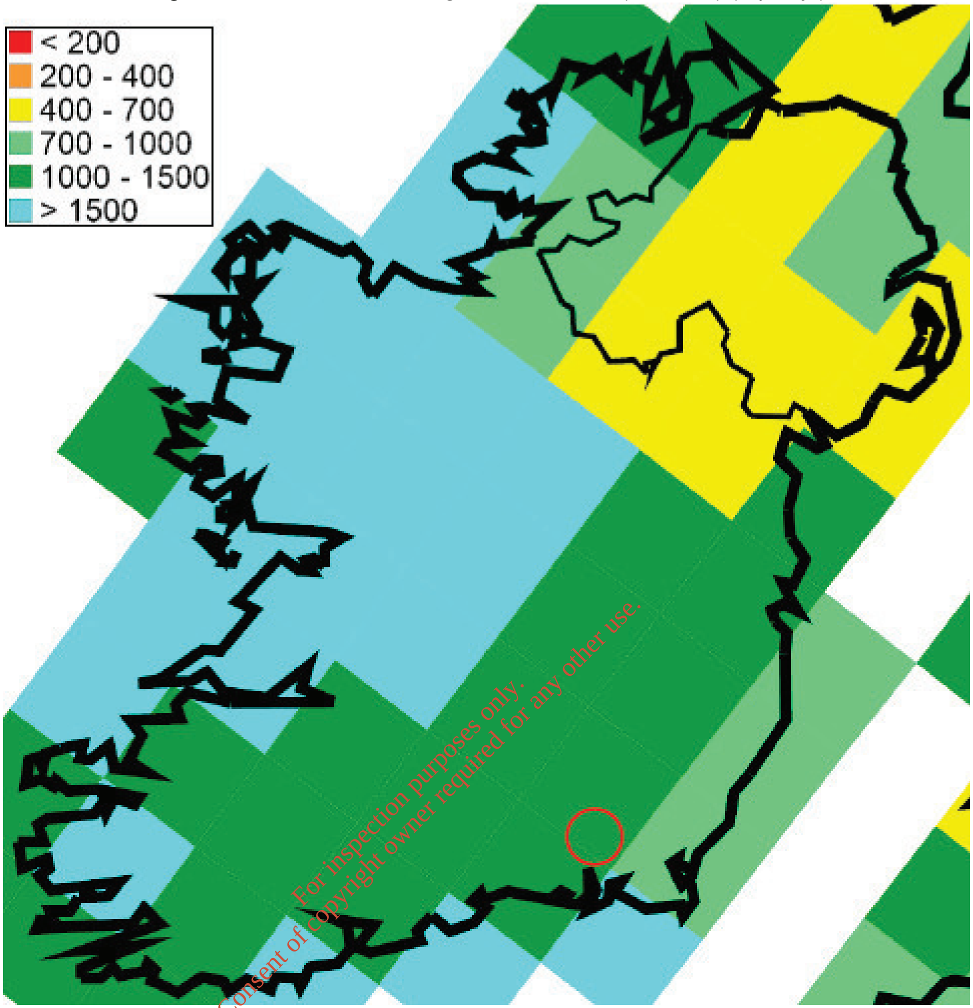
5th Percentile All Ecosystems. Netherlands Environmental Assessment Agency (2005)
European Critical Loads and Dynamic Modelling: CCE Status Report 2005

Figure 15.2: Maximum Sulphur Critical Load (CLmaxS) (eq1/ha/yr)



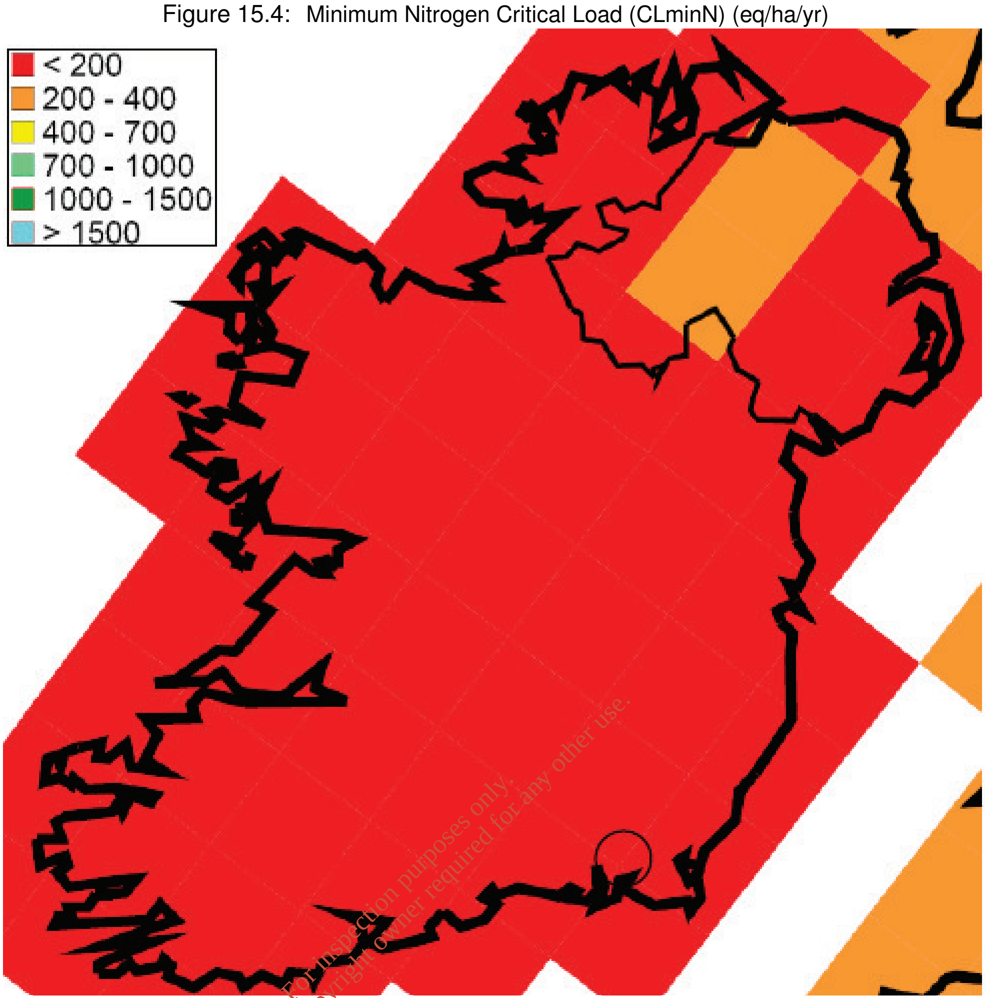
5th Percentile All Ecosystems. Netherlands Environmental Assessment Agency (2005) European Critical Loads and Dynamic Modelling: CCE Status Report 2005

Figure 15.3: Maximum Nitrogen Critical Load (CLmaxN) (eq/ha/yr)



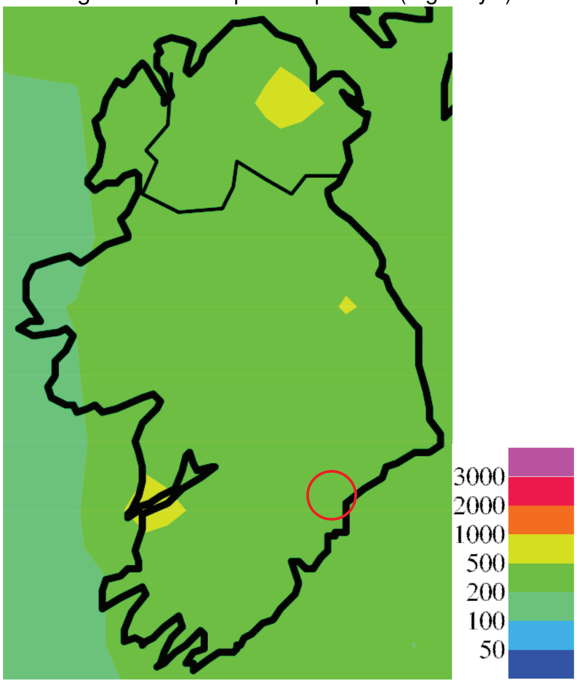
5th Percentile All Ecosystems, Netherlands Environmental Assessment Agency (2005) European Critical Loads and Dynamic Modelling: CCE Status Report 2005

Figure 15.4: Minimum Nitrogen Critical Load (CLminN) (eq/ha/yr)



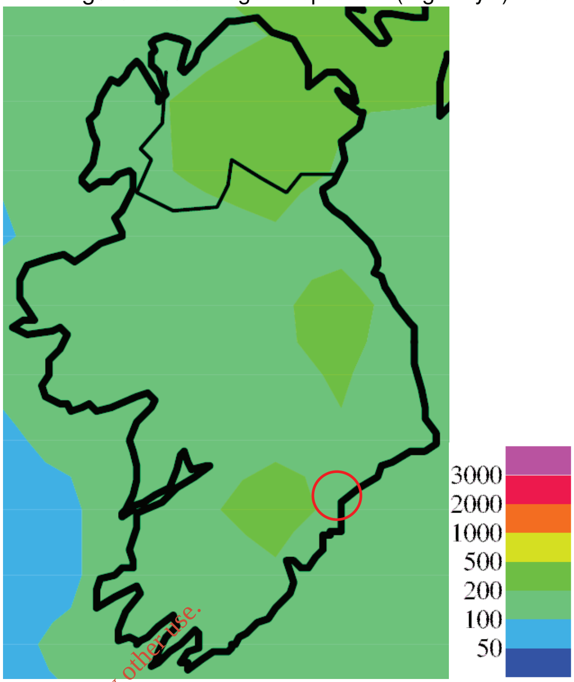
5th Percentile All Ecosystems Netherlands Environmental Assessment Agency (2005) European Critical Loads and Dynamic Modelling: CCE Status Report 2005

Figure 15.5: Sulphur Deposition (mg.m[2] yr[1]) 2004



Source: Netherlands Environmental Assessment Agency (2005) European Critical Loads and Dynamic Modelling: CCE Status Report 2005.

Figure 15.6 Nitrogen Deposition (mg.m[2] yr[1]) 2004



Source: Netherlands Environmental Assessment Agency (2005) European Critical Loads and Dynamic Modelling: CCE Status Report 2005.