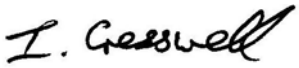
Proposed Replacement Coal-fired Units for Kingsnorth Power Station

ENVIRONMENTAL STATEMENT

Compiled by Power Technology
On behalf of E.ON UK plc

Approved by



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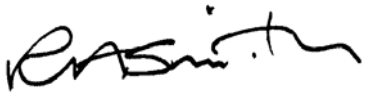
Authorised for Issue by



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Preface

This Environmental Statement has been prepared by Power Technology, on behalf of E.ON UK plc, to accompany its application to the Secretary of State for Trade and Industry for consent under Section 36 of the Electricity Act 1989 to construct Supercritical Coal-Fired Power Plant at Kingsnorth in Kent.

E.ON UK plc is considering replacing its existing coal-fired plant at Kingsnorth power station with two 800MW supercritical coal-fired units, as a means of maintaining generation capacity in the area once the existing station ceases generating and reducing emissions of carbon dioxide into the atmosphere due to the enhanced efficiency of the new plant. The proposed supercritical coal-fired plant is to be located within the Kingsnorth power station land holding and will be referred to as Kingsnorth units 5 and 6 or the “new units” throughout this document.

This document has been produced in accordance with the requirements of the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000. It presents an analysis of the implications of the proposal to construct and operate the new units. This Environmental Statement is presented in three main sections:

Part 1: **Introduction** – the background to the project is reviewed in the context of consent procedures and the planning framework.

Part 2: **The Site and the Project** - considers aspects of the supercritical coal-fired plant design and the construction phase for the proposed new units.

Part 3: **Environmental Impact Assessment** – details the effects of the proposed new units on the environment in terms of emissions, site ecology and history, visual aspects, noise, flood risk, traffic and the socio-economic implications for the local community.

A glossary of terms and abbreviations, and a list of references are also included.

A Non-Technical Summary (NTS) of the Environmental Statement has been produced as a separate document, in accordance with requirements of the Regulations above.

The Environmental Statement and the Non-Technical Summary (together with relevant reference documents) have been placed on deposit at the following addresses, where, at those marked with an asterisk, they may be examined by members of the public during normal opening hours:-

The Department of Trade and Industry at the following address:-

DTI
1, Victoria Street
London SW1H 0ET

Copies of this document have also been issued to the following bodies:-

Development Control *
Medway County Council
Compass Centre
Chatham Maritime
Chatham
Kent ME4 4YH

Kent County Council
County Hall
Maidstone
Kent ME14 1XX

Natural England
The Countryside Management Centre
Coldharbour Farm
Wye
Ashford
Kent TN25 5DB

Natural England
Sterling House
7 Ashford Road
Maidstone
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English Heritage
Customer Services Department
PO Box 569
Swindon SN2 2YP

Environment Agency
Orchard House
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Kent ME19 5SH

The RSPB
South East England Office
2nd Floor
42 Frederick Place
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Kent Wildlife Trust
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Kent ME14 3BD

Hoo St Werburgh Parish Council
4 Birk Hall Close
Walderslade
Chatham
Kent ME5 7QD

Medway Ports Authority
Sheerness Docks
Sheerness
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ME12 1RS

Hoo Library *
Church St Hoo,
Rochester,
Kent ME3 9AL

Strood Library *
32 Bryant Road,
Strood,
Rochester,
Kent ME2 3EP

The Environmental Statement and the Non-Technical Summary are also available on-line at the E.ON UK website www.eon-uk.com/supercritical

Printed copies and CDs of the Environmental Statement and Non-Technical Summary may be obtained by writing to E.ON UK plc at the following address:-

Adrian Smith
Project Manager
E.ON UK plc
Westwood Way
Wetwood Business Park
Coventry
CV4 8LG

A discretionary charge may be requested for each printed copy or CD of the Environmental Statement. Any requests for further information on the proposed Kingsnorth units 5 and 6 or information relating to E.ON UK plc in general should be made to Adrian Smith at the above address.

Further information concerning this project is available for local residents via the freephone information line (0800 0198315).

Contents

Introduction

1.1 Background to the Proposed Development

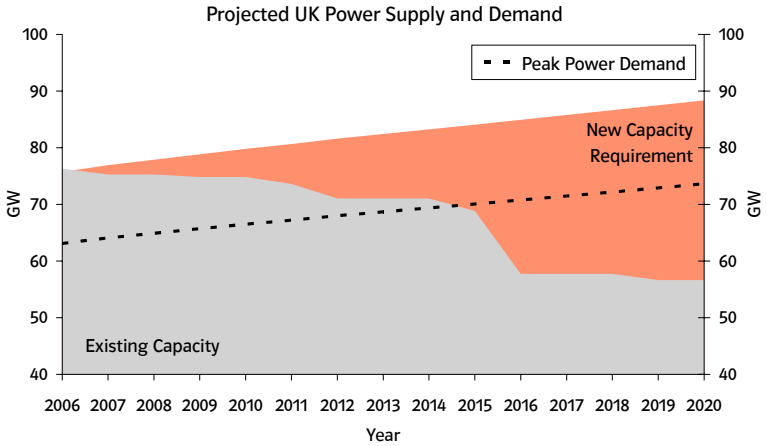
E.ON is the world's largest privately owned energy company. Electricity and gas are its core business with leading positions in Europe and the US Midwest. E.ON UK plc's holding company, E.ON AG, is based in Düsseldorf and is responsible for managing the E.ON group as a whole. E.ON UK plc was formed following E.ON's purchase of Powergen UK plc in 2002. Powergen UK plc was formed in 1989 from the Central Electricity Generating Board (CEGB) as part of the privatisation of the electricity industry in the United Kingdom.

As North Sea gas reserves diminish, the UK is forecast to rely increasingly on imported natural gas including that used for combustion in electricity generation, E.ON UK believes that there is an important role for coal, renewables and other innovative technologies in the generation portfolio for the UK, in order to ensure security of supply.

Recent EU driven legislation is expected to have a major impact on the generation industry. In 1997 the UK government signed up to the Kyoto Protocol and made a commitment to reduce green house gas emissions (GHGs), in particular carbon dioxide (CO_2) and help to tackle climate change. This has led to the introduction of a number of schemes / directives which will impact on the energy industry, which is the largest single contributer to GHG emissions in the UK. In particular the introdution of the Integrated Pollution Prevention and Control (England and Wales) Act 1999 and the EU Large Combustion Plants Directive 2001/80/EC , which require a reduction of GHGs from large industrial installations through a system of Best Available Technology to minimise the impact on the environment.

Therefore, E.ON UK realises that although coal, renewables and other innovative technologies may offer a diverse and therefore more secure fuel mix, these solutions must have a low environmental impact and a low carbon footprint to meet with legislative requirements currently placed on the industry.

Over the next few years, up to 2020, a large number of existing coal, oil and nuclear power plants will close and must be replaced. This includes the existing coal-fired units at Kingsnorth which under the Large Combustion Plant Directive legislation will be limited to 20,000 hours operation from 2008 and must close by end of 2015 at the latest.



This replacement must be done in a way that assists with tackling the dual challenges of climate change and maintaining security and diversity of energy supplies to UK homes and business. This is particularly relevant as the UK becomes increasingly reliant on imported gas supplies.

E.ON UK believes that these challenges can be met and is actively investing in many different projects in the UK to achieve this.

- Investing in new gas-fired generation capacity such as the two planned for brownfield sites at Grain on the site of the existing oil-fired power station and at Drakelow in the Midlands on the site of a former coal-fired power station which has recently been demolished
- Operating 190MW of renewable wind and 56MW of hydro generation
- Co-firing renewable biomass at two of its three coal-fired power stations.
- Investing in a 50MW dedicated biomass plant at Lockerbie with a similar scheme being considered for an area of the Kingsnorth site
- Planning to replace existing coal-fired units with new cleaner coal technology at Kingsnorth, the subject of this consent application.
- Planning demonstration projects for new technologies that show promise for the future, including marine renewables and coal gasification with carbon capture and storage
- Funding research and development at a number of UK Universities into projects that show promise further into the future.

Although diverse in nature all these projects use the latest technology to deliver reliable, affordable energy with a lower environmental impact than those they replace.

E.ON UK believes that coal in particular can play a significant role in maintaining security of supply and generating capacity in the UK. There are a number of large, evenly distributed, easily extracted coal supplies which provide a low priced stable market for this fuel, but it is realised that it can only contribute to power generation if techniques are used to lower its environmental impact in terms of emissions.

Therefore, E.ON UK is considering replacing the four existing 485MW sub-critical coal-fired units at Kingsnorth with two 800MW modern high efficiency supercritical coal units, referred to as Kingsnorth units 5 and 6. The supercritical units offer higher operating efficiencies than the existing subcritical plant and so would reduce carbon dioxide emission per unit of electricity by around 20% compared to the units they replace. Other air emissions would also be significantly reduced. If consent is given then the new units could be operational as early as 2012.

Deployment of carbon capture and storage (CCS), which involves the removal of CO_2 from the flue stream and injecting it into suitable geological storage, e.g. depleted oil and gas fields, will be considered as an option for GHG emission reduction at the Kingsnorth site by E.ON UK at a later date. This will be subject to the process of CCS being allowed by law and incentivised by a suitable framework and technological hurdles for the process being overcome so that proven technology becomes available for the process of capture and storage. With this in mind the proposed units will be designed “capture ready” to allow retrofit at a later date.

The chosen site at Kingsnorth is well placed to provide electricity to the South East of England, where there is currently a deficit of generation plant compared to the demand of the area. Failure to maintain existing generation capacity in the South East (or indeed to increase capacity) will place further reliance on the national transmission system and increase transmission system losses.

Section 36 of the Electricity Act 1989 requires that a generating station of greater than 50MWe shall not be constructed, extended or operated except in accordance with a consent granted by the Secretary of State. Hence, the development of the replacement plant falls under the Act and is the subject of an application for consent and deemed planning permission.

If built, the proposed Kingsnorth units 5 and 6 will be located to the north of the existing generating plant (see Figure 2.1.1), within an area defined by the original consent for the Kingsnorth power station.

On completion of the new units it is the intention to demolish the four existing units at Kingsnorth power station, but this will be the subject of future discussions and is not part of the scope of the application for consent to construct the new units. .

1.2 Consents Procedure

The plant is subject to an application for consent to the Secretary of State under Section 36 of the *Electricity Act 1989.* Section 90 of the *Town and Country Planning Act 1990* provides that, on granting the aforementioned consent, the Secretary of State may direct that planning permission for the development shall be deemed granted.

Section 36 of the *Electricity Act 1989* requires that a generating station of greater than 50MWe shall not be constructed, extended or operated except in accordance with consent granted by the Secretary of State. Hence, the development of Kingsnorth units 5 and 6 falls under the Act and is the subject of an application for consent and deemed planning permission.

The operation of Kingsnorth units 5 and 6 will be a Part A1 process under Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000. The aim of Pollution Prevention and Control is to minimise the environmental impact of large industrial installations on the environment using a system of Best Available Techniques (BAT) for the prevention of pollution and a system of compliance control operated by the Environment Agency for Part A1 processes. An application for a permit to operate a Part A1 process will be required from the Environment Agency and an application will be made for such in due course.

1.3 Planning Framework

The site falls within the area covered by the Medway Local Plan (adopted version 2003). Also relevant is the Medway Local Transport Plan 2006-2011 and the Kent and Medway Structure Plan 2006.

Also relevant is the Regional Planning Guidance for the South East (RPG9), March 2001 and The Thames Gateway Planning Framework (RPG9A) published in 1995.

Due consideration has been given to the policies which relate to the proposal to construct and operate the proposed units 5 and 6 at Kingsnorth power station. The following extracts and commentary are based on the plans referred to above.

1.3.1 Regional Planning Guidance for the South East (RPG9)

The primary purpose of RPG9 is to provide a regional framework for the preparation of local authority development plans. The guidance has *'a vision of encouraging economic success throughout the Region, ensuring a higher quality of environment with management of natural resources, opportunity and equality for the Region's population, and a more sustainable pattern of development'.*

The Guidance sets out the four objectives for sustainable development, being:-

a) Social progress which recognises the needs for everyone
b) Effective protection of the environment
c) Prudent use of natural resources, and
d) Maintenance of high and stable levels of economic growth and employment

The proposed units 5 and 6 will achieve an efficiency of about 45% or higher, considerably higher than the efficiency of the existing coal-fired plant, which is about 37%. This will ultimately help to reduce the consumption of fossil fuels. The units will be fitted with Flue Gas Desulphurisation (FGD) plant and a process of selective

catalytic reduction (SCR) which collectively will reduce significantly emissions of sulphur dioxide (SO_2) and nitrogen oxides (NOx). These measures, with reduced fuel usage fuel from higher efficiencies, will assist with the protection of the environment.

The construction and installation of units 5 and 6 will help secure the future operation of the Kingsnorth power station and employment there, beyond the current expected lifetime of the existing plant. Under current legislation the existing coal-fired plant at Kingsnorth must close by the end of 2015.

The development of high efficiency coal plant will also help the UK to have greater fuel diversity for the generation of electricity ; currently gas accounts for about 38.5% and nuclear about 20.5% of electricity production in the UK. Coal was about 34% in 2005.

RPG 9 sets out policies to help achieve a high quality environment for the South East. The policies that are of particular relevance to this proposal are set out below.

Policy E1

Priority should be given to protecting areas designated at international or national level either for their intrinsic nature conservation value, their landscape value or their cultural importance.

Units 5 and 6 will be constructed on land designated for industrial development. The effects on neighbouring protected areas, discussed in detail in Section 3.5, are not judged to be significant as they represent a reduced impact compared to historic and current operations at the site that have proved compatible with the protected areas being initially designated as and remaining of conservation value.

Policy E7

Local Authorities should work with the Environment Agency and others to play a positive part in pollution control and encourage measures to improve air quality.

Details of measures to increase plant efficiency and to reduce emissions have been set out in previous paragraphs. E.ON UK will continue to work with the Environment Agency to improve pollution control. Formally, the new units will require a Licence to Operate from the Environment Agency and will need to demonstrate that the proposed plant needs the standards of Best Available Technology.

The new units will make provision for carbon capture plant for installation when technology is proven and off-shore CO_2 storage is permitted.

Units 5 and 6 will therefore make a positive contribution to the objectives of Policy E7.

RPG 9 refers to the need for an efficient and effective freight distribution system and seeks to develop an integrated transport system. It recognises that road freight will continue to predominate but seeks to also to realise the potential of rail, inland waterway and coastal shipping networks for the movement of freight.

Policy T6

A fully integrated freight distribution system should be promoted which makes the most efficient and effective use of road, rail, inland waterways, and coastal shipping.

Once constructed, the operation of Units 5 and 6 will use a mix of transport systems. The delivery of coal and limestone and the removal of gypsum will be by coastal shipping. Ash will continue as at present to be removed by road.

The short-term temporary construction traffic would use the road network. It is possible that coastal shipping could be used for some large plant items, such as electrical generators and transformers. The effects of this additional road traffic are discussed in detail in Section 3.7.

RPG 9 also has a policy on energy production, below

Policy INF4

In planning the future development of the region and activities within it, priority should be given to energy conservation and to maximising the use of renewable energy sources as an alternative to fossil fuels

E.ON UK is committed to the development of renewable energy sources, having 653 MW already installed in the UK with 1450MW at various stages of development. This includes on-shore and off-shore wind farms. E.ON UK is also developing new projects that use biomass as the principal fuel, which will be burned at standalone biomass power generating plants. E.ON UK is currently constructing a 50MW waste-wood burning plant at Lockerbie.

Biomass can also be co-fired at fossil fuelled plants. Biomass is currently co-fired at Kingsnorth and Ironbridge power stations.

1.3.2 The Thames Gateway Planning Framework (RPG 9A)

The Thames Gateway Planning Framework embodies the vision for the future of the area previously known as the East Thames Corridor, and encompassing the Hoo Peninsula.

RPG9A provides guidance rather than setting policies and refers to specific regions within the Thames Gateway planning area. Regarding the Hoo Peninsula, RPG 9A states:-
The increasing emphasis throughout the Thames Gateway on environmental improvement and need to avoid prejudicing the principal development opportunities, makes it likely that sites for 'poor-neighbour' uses will become increasingly scarce. Also, there will be increasing pressure to avoid the loss of prime sites to land intensive uses with low employments rates. The size and remoteness of the large industrial sites on the Isle of Grain and Kingsnorth makes them suitable for accommodating those employment uses which may not be easily accommodated elsewhere.

Units 5 and 6 and ancillary plant will be constructed partially on land already developed by the existing power station and is therefore not available for other

industrial developments. Additional land, currently undeveloped but designated for industrial use, will also be required. This additional land is with the ownership of E.ON. Ultimately the closure and demolition of the existing coal station will create the potential for further employment uses.

1.3.3 Medway Local Plan Adopted Version 2003

Policy S1: Development Strategy (Part)

Strategic economic development provision will be made both within the urban area and at Kingsnorth and Grain.

In recognition of their particular quality and character, long-term protection will be afforded to:

(i) areas of international, national or other strategic importance for nature conservation and landscape;

The construction of units 5 and 6 at Kingsnorth will not affect the opportunities for other industrial developments at Kingsnorth and Grain. On completion of the construction of units 5 and 6 and demolition of the existing plant at Kingsnorth additional land may become available for strategic economic development. The proposal maintains protection of nature conservation and landscape interests.

Policy S2: Strategic Principles (Part)

The implementation of the development strategy set out in policy S1 will focus on:

(i) Maintaining and improving environmental quality and design standards;

Units 5 and 6 will be designed to a high standard to integrate with the existing industrial developments on the site and the surrounding areas. Improved environmental quality is achieved with the significantly improved operating efficiency of the proposed new units compared to the existing plant and measures to reduce SO_2, NO_x and CO_2 emissions.

Policy S3: River Medway

Proposals which are consistent with nature conservation, landscape and hydrological policies and which have no adverse impact upon coastal archaeological will be permitted that develop the River Medway for:

(i) public access along the riverbank through the construction of riverside walks and cycle-ways;
(ii) use as a transportation corridor, both for freight and passengers;
(iii) appropriate commercial, tourism and leisure development along the river's edge of a high quality design;
(iv) recreational and tourism purposes

The inter-tidal habitats of the Medway are an important natural resource. Where any proposed development would affect the inter-tidal habitats, an assessment of its impact will be required. Where development is proposed that will result in any loss of inter-tidal habitats, proposals must include compensatory inter-tidal habitats sufficient to mitigate any loss.

The effects on the inter-tidal areas, discussed in detail in Section 3.2, are judged to be insignificant. In particular, the scale of impact will be reduced compared with

current and historic operations from the existing power station units that will be closed when the proposed new units begin operation.

Policy S12: Kingsnorth

At Kingsnorth, as defined on the proposals map, Class B2 General Industrial Development and Class B8 Storage and Distribution Uses will be permitted. Class B1 uses will be permitted but will be restricted to Class B1(c) except where the development makes provision for increased accessibility by means other than the private car. Provision will be made within the site for the relocation of businesses from urban regeneration sites, including special industrial uses and others not in Class, subject to access and environmental considerations. Medway Council will prepare a development brief in association with the landowners. All development will be subject to the protection of nature conservation interests.

Developments which do not require access to the railway or to the river, but which would prejudice use of, or access to, the wharves or rail sidings will not be permitted.

Contributions will be sought to the improvements of off-site highways or the rail link to Kingsnorth where such improvements are needed from a practical point of view to enable the development to go ahead or are necessary from a planning point of view and are so directly related to the proposed development and to the use of land after its completion, that the development ought not to be permitted without it.

On completion of construction of the development, all operating plant comprising of units 5 and 6 and ancillary plant, will lie within the boundary of Kingsnorth, as defined on the proposal map. Although the proposed development is not within the classes of development defined by Policy S12, reference should also be made to Policies ED7 and ED8. These Policies, referred to below, identify that the development of Special Industrial Uses (ED7) and Industrial Uses not in Class (ED8) will be permitted at Kingsnorth subject to environmental considerations.

To-date, the development brief referred to in Policy S12 has not been published.

This development requires access to the river for the transportation of coal and limestone to the site, and for the transportation of gypsum from the site to a wall-board manufacturing plant. During construction some heavy loads are likely to transported to site by roll-on/roll-off barges.

The operation of the coal station also requires access to the River Medway for cooling water.

E.ON is committed to making a contribution to local road improvements and will enter into negotiations with Medway Council to agree the level of financial contribution.

Policy BNE1: General Principals for Built Development

The design and development (including extensions, alterations and conversions) should be appropriate in relation to the character, appearance and functioning of the built and natural environment by:

(i) being satisfactory in terms of use, scale ,mass, proportion, details, materials layout and siting; and

(ii) respecting the sale, appearance and location of buildings, spaces and the visual amenity of the surrounding area; and

(iii) where appropriate, providing well structured, practical and attractive areas of open space.

The proposal is for the construction of additional plant partially an existing industrial development and partially on land not currently developed but designated for industrial use. The visual impacts and effects on visual amenity are described in detail in Section 3.6 and are judged to be satisfactory.

Policy BNE2: Amenity Protection

All developments should secure the amenities of its future occupants, and protect those amenities enjoyed by nearby and adjacent properties. The design of the development should have regard to:
(i) privacy, daylight and sunlight; and
(ii) noise, vibration, light, heat, smell, and airborne emissions consisting of fumes, smoke soot, ash, dust and grit; and
(iii) activity levels and traffic generation.

The design of the development and management of construction activities will ensure that the amenities of nearby properties are protected.

Policy BNE 3 Noise Standards (Relevant Part)

Noise generating development should be located designed so as not to have a significant adverse noise impact on any nearby noise sensitive uses (including offices, hospitals, schools and, in respect of noise emanating from non-transport related sources, housing.

A noise analysis have been undertaken, and discussed in detail in Section 3.8. The construction and operation of the development will not have a significant effect on nearby properties.

Policy BNE5: Lighting.

External lighting schemes should demonstrate that they are the minimum necessary for security, safety or working purposes. Development should seek to minimise the loss of amenity from light glare and spillage, particularly that effecting residential areas, areas of nature conservation interest and the landscape qualities of countryside areas.

On completion of the development external lighting should be no greater than from the existing development on the Kingsnorth site. Some external lighting may be necessary during construction but will be kept to a practical minimum, consistent with safety and security requirements. Construction activities will normally be restricted to day-time working hours when external lighting may not be necessary.

Policy BNE 22: Environmental Enhancement

Development leading to the protection and improvement of the appearance and environment of existing and proposed areas of development, transport corridors, open spaces and areas adjacent to the River Medway will be permitted.

The proposed development is for the construction of additional plant on an industrial site. The objective will be to help to achieve compatibility with the surroundings. The visual effects of the additional plant are described in Section 3.6.

Policy BNE 23: Contaminated Land

Development on land known or likely to be contaminated or affected by adjacent or related contamination must be accompanied by the findings of a detailed site examination to identify contaminants and the risks that these might present to human health and the wider environment. Appropriate measures to reduce, or eliminate, risk to building structures, services and occupiers of the site and of adjoining sites must be agreed. Such remedial measures must be implemented before the development is occupied.

The site does not pose a significant risk to the environment and, assuming continued industrial or commercial usage, human health risks associated with ground contamination are also considered to be low. The site has no history of industrial usage prior to the construction of the existing coal-fired power station.

Policy BNE 24: Air Quality

Development likely to result in airborne emissions should provide a full and detailed assessment of the likely impact of these emissions. Development will not be permitted when it is considered that unacceptable effects will be imposed on the health, amenity or natural environment of the surrounding area, taking into account the cumulative effects of other proposed or existing sources of air pollution in the vicinity.

Air quality modelling and an assessment have been undertaken which is discussed in detail in Section 3.1. The conclusion is that the relevant air quality standards are easily met.

Policies BNE 35, BNE 36 and BNE 37, below, collectively seek to protect International, national and local wildlife interests.

BNE 35: International and National Nature Conservation Sites (Part)

International and National Conservation Sites, as defined on the proposals map, will be given long term protection:

(i) classified and potential Special protection Areas (SPAS);
(ii) listed and proposed Ramsar sites;
(iii) National Nature Reserves
(iv) Sites of Special Scientific Interest.

Development that would materially harm, directly or indirectly, the scientific or wildlife of these sites will not be permitted unless the development is connected with, or necessary to, the management of the site's wildlife interest.

BNE 36: Strategic and Local Nature Conservation Sites (Part)

Strategic and Local Nature Conservation Sites, as defined on the proposals map, will be given long term protection:
(i) Sites of Nature Conservation Interest;
(ii) Designated and proposed Local Nature Reserves.

Development that would materially harm, directly or indirectly, the scientific or wildlife interest of these sites will not be permitted unless the development is connected with, or necessary to, the management of the site.

BNE 37: Wildlife Habitats

Development that would cause a loss, directly or indirectly, of important wildlife habitats or features not protected by policies BNE35 and BNE36 will not be permitted, unless:
(i) there is an overriding need for the development that outweighs the importance of these wildlife resources; and
(ii) no alternative site is (or is likely to be) available if ancient woodland, inter-tidal habitats and calcareous (chalk) grassland would be lost; and
*(iii) the development is designed to minimise the loss involved**;** and*
(iv) appropriate compensatory measures are provided.

A detailed ecological survey has been undertaken and discussed in Section 3.5. It concludes that there is no material harm to wildlife interests in the International, National and Local nature conservation sites adjacent and local to the proposed development. In particular, the scale of impact will be reduced compared with current and historic operations from the existing power station units that will be closd when the proposed new units begin operation.

Policy BNE 45: Undeveloped Coast

Development will be permitted in and alongside the undeveloped coast as defined on the proposals map, only if:
(i) a coastal location is essential and no suitable alternative site exists along the developed coast; and
(ii) the scenic, heritage or scientific value of the undeveloped coast is maintained and, where consistent with this and where practicable, public access to the coast is improved; and
(iii) the development is not likely to be at risk from flooding or coastal erosion to the extent that it would require defence works for its safety and protection.
And
Policy BNE 46: Developed Coast

Development will be permitted in and alongside developed coast, as defined on the proposals map, when:
(i) the appearance and environment of the coast is improved; and

(ii) coastal erosion will not threaten any new building proposed as part of the development; and
(iii) public access to the coast is improved, where practicable and whenever appropriate; and
(iv) the need for the coastal location is justified when the development is outside existing settlement boundaries and Economic Development Areas.

The need for the coastal location is fully justified, as the construction of units 5 and 6 can make use of existing infrastructure on the Kingsnorth power station site. The appearance of the additional and existing plant has fully discussed in Section 3.6. The existing flood defences will fully protect the new plant from coastal erosion. Public access to the coast will remain un-changed.

Policy ED1: Existing Employment Areas (Part)

In the following Employment Areas, as defined on the proposals map, development will only be permitted for:
(B) Business (Class B1), General Industry (Class B2) and Storage and distribution (Class B8) at:

(xiv) Kingsnorth

Proposals of development on the above sites resulting in a loss of industrial, business or storage and distribution development to other uses will not be permitted.

And

Policy ED5: Proposed Employment Areas (Part)

The following sites, as defined on the proposals map, are allocated for the development for the use classes specified:

(B) Business (Class B1), general industry (Class B2) and storage and distribution (Class B8) development at:

(i) Kingsnorth, subject to policy S12
(ii) Isle of Grain/Thamesport, subject to policy S13
(iii) Rochester Airfield (25 hectares)

Units 5 and 6 will be constructed on land within E.ON UK ownership and not available for other industrial uses. On completion of the construction of units 5 & 6 and demolition of the existing station it is possible that land could be made available for other industrial developments as defined in Policy S12.

Policy ED7: Special industrial Sites

The development of special industrial uses will only be permitted at Kingsnorth and Grain, as defined on the proposals map, subject to the provisions of policies BNE2, BNE3, BNE23 and BNE 24 and securing the transport infrastructure improvements specified on policies S12 and S13.

The proposal to construct and operate Units 5 and 6 at Kingsnorth is compliant with policies BNE 2, BNE3, BNE23 and BNE 24, which are referred to earlier in this

section. Inevitably road transport will be used for the majority of construction deliveries and, as at present with the existing station, for the removal of ash. The road network is judged to be adequate with no further improvements necessary. Mitigation measures to minimise the effects of traffic during the construction period are recommended in Section 3.7.

Policy ED8: Industrial uses not in a Use Class

The development of industrial uses not in a use class will be permitted at Kingsnorth and the Isle of Grain, as defined on the proposals map, subject to the provisions of policy BNE2 and there being no adverse environmental impact, especially in terms of residential amenity, nature conservation interests or the character of the surrounding rural area.

The proposed construction and operation of units 5 and 6 is compliant with policy BNE2 which is referred to earlier in this section. The environmental assessment, summarised in this Environmental Statement, confirms that there are no significant environmental impacts.

Policy T1: Impact of Development

In assessing the highways impact of development, proposals will be permitted provided that:

(i) the highways network has adequate capacity to cater for the traffic which will be generated by the development, taking into account alternative modes to the private car; and
(ii) the development will not significantly add to the risk of road traffic accidents; and
(iii) the development will not generate significant HGV movements on residential roads; and
(iv) the development will not result in traffic movements at unsociable hours in residential roads that would be likely to cause loss of residential amenity.

An assessment of the highways network has been undertaken and discussed in detail in Section 3.7. It concludes that the requirements of policy T1 are met.

Policy CF9: Power Stations

Further power stations will not be permitted unless it can be demonstrated that a clear and specific local need exists.

This proposal to construct units 5 and 6 can be regarded as a replacement for the existing coal-fired plant that, under current legislation, must close by 2015. It may defer the need for further generation capacity to be developed in the area.

1.3.4 The Thames Gateway Planning Framework (RPG 9A)

There are no policies specific to the Kingsnorth power station site. However there are a number of policies, which although non-site specific, can be taken to apply to a development on the Kingsnorth site.

Policy SP1: Conserving and Enhancing Kent's Environment and Ensuring they Sustainable Pattern of Development (Part)

The primary purpose of Kent's development and environmental strategy will be to protect and enhance the environment and achieve a sustainable pattern and form of development. This will be done principally by:

- *Protecting the Kent countryside and its wildlife for future generations;*
- *reducing reliance on greenfield sites to accommodate all forms of built development;*
- *using and reusing land and buildings for development more efficiently;*
- *protecting and enhancing features of importance in the natural and built environment*
- *supporting the retention and growth of Kent's employment and investment in a manner that contributes to a sustainable pattern of development;*
- *responding to the implications of the long term climate change by: --*
  advancing the conservation and prudent use of energy, water and other natural resources;
  minimising pollution and assisting the control of greenhouse gas emissions;
  safeguarding areas of potential flood risk from development.

Units 5 and 6 will achieve an efficiency of 45% or higher. High efficiency plant contributes to the objective of minimising pollution. High efficiency plant, together with measures to incorporate FGD plant and SCR process, combine to develop a sustainable form of development. The plant will need to meet the design requirements of Best Available Technology (BAT).

Policy SS1: Spatial Priorities for Development and Investment in Kent and the role of the settlement hierarchy (part)

The main priorities for development and investment in Kent, on particularly public funding, will be focused upon the:
(i) The regional growth areas:
- *Kent Thames Gateway within North Kent;*
- *At Ashford: and*

(ii) In East Kent at the coastal towns in the Priority Areas for Economic regeneration.

The development of units 5 and 6 represent a significant investment in the Thames Gateway area.

Policy SS4: Priority for previously developed land and a sequential approach to the location of development

In the preparation of Local Plans for Local Development Documents, development requirements which are not met by sites with existing planning permission should be provided through the consideration of, firstly, previously developed land or previously used buildings and then greenfield land. Assessment of development locations will follow, as appropriate, the sequential consideration of sites set out in Policies HP2, EP3, and EP15 of this Plan.

The construction of Units 5 and 6 will maintain employment at the Kingsnorth power station site without affecting the scope for further industrial developments. The environmental assessment concludes that this development can proceed in a manner that respects the environment.

Policy ME1: Medway (Part)

Completion of improvements to the A228 together with rail access improvements to support growth of Thamesport and industrial and commercial development at Grain and Kingsnorth will be promoted.

Improvements to the A228 between the 4 Elms Roundabout and Roper's Lane (the access road to Kingsnorth) have been completed.

Policy EN2: Protecting Kent's Coast and Estuaries

Kent is undeveloped coast and estuaries will be protected, conserved and enhanced. Development in such areas and in adjoining countryside will not be permitted if it materially detracts from the scenic, heritage, wildlife or scientific value all these areas. Development so permitted should include inappropriate medication and/or compensation.

The environmental assessment concludes that with the mitigation measures proposed there will be no loss of wildlife habitats. The development of Units 5 & 6 at Kingsnorth will be part of an existing industrial scene and there will not be a significant detrimental effect on the landscape of Kent.

Policy EN6: International and National Wildlife Designations

Development will not be permitted when it would directly, he directly or cumulatively, the cheerily harm the scientific or nature conservation interests of any of the following categories of sites:

- *a European site;*
- *a proposed European site;*
- *a Ramsar site*
- *a Site of Special Scientific Interest;*
- *a National Nature Reserved.*

The environmental assessment has demonstrated that there will not be a material harm to the scientific or wildlife interests of the protected areas adjacent or close to the site of the proposed development. In particular, the scale of impact will be reduced compared to current and historic operations from the existing power station units which will be shut down when the proposed new units begin operation.

Policy EN8: Protection, Conservation and Enhancement of Biodiversity

Wildlife habitats and species will be protected, conserved and enhanced, especially through long-term management and habitat creation schemes, particularly when they have been identified as national and County priorities in the UK and Kent Biodiversity Action Plan(s), or where they are protected under the wildlife legislation. This will be secured by:

a) ensuring that site evaluation is undertaken to establish the nature conservation value of the proposed development sites;

b) identifying and, safeguarding and managing existing and potential land for nature conservation as part of development proposals, particularly where a connected series of sites can be achieved;

c) local planning authorities identifying locations and proposals for habitats and species management, restoration and creation.

Development likely to have an adverse affect, directly, indirectly or cumulatively, on important habitats or species will not be permitted unless:

- *There is an overriding need for the development that outweighs adverse impact on nature conservation, and*
- *adverse impact on an important nature conservation resource can be adequately mitigated and/or compensated.*

This Environmental Statement concludes that there will be no material harm to important habitats or species, and proposes appropriate mitigation measures.

Policy QL1: Quality of Development and Design (Part)

(i) All development should be well designed and be of high quality. Developments, individually or taken together, should respond positively to the scale, layout, pattern and character of their local surroundings. Development which would be detrimental to the built environment, amenity, functioning and character of settlements or the countryside will not be permitted. Existing built environment of high quality and character will be protected and enhanced. Innovative design will be encouraged where appropriate.

E.ON UK intends to work closely with the selected contractors and Medway Council to ensure that the final design and architectual treatment is of a high quality. For instance, the exterior design of the boiler house will be discussed with relevant bodies as various architectural treatments are possible.

Policy QL7: Archaeological Sites

The archaeological and historic integrity of the scheduled ancient monuments and other important archaeological sites, together with their settings, will be protected and, where possible, enhanced. Development which would adversely affect them will not be permitted.

Where important or potentially important archaeological remains may exist, developers will be required to arrange for archaeological assessment and/or field evaluation to be carried out in advance of the determination of planning applications.

When the case for development affecting an archaeological site is accepted, the archaeological remains should be preserved in situ. Where preservation in situ is not possible or justified, appropriate provision for preservation by record will be required.

This Environmental Statement identifies the potential for the survival of significant archaeological deposits and makes recommendations for site evaluation which can be undertaken prior to the commencement of development.

Policy EP1: Land, Workforce, Education and Skills (Part)

To improve the skills and qualifications of the workforce in Kent and to support the development of the Kent economy, and particularly in the technology, research and knowledge based industries:

- *land and premises will be provided for education and skills training purposes;*
- *the improvement of education and skills training will be encouraged and fostered having regard to the spatial strategy and regeneration policies of this Plan.*

Currently E.ON UK directly employs over 160 staff at Kingsnorth with approximately a further 90 support staff on a contract basis. The development of Units 5 and 6 will require similar numbers for its on-going operation (although there are fewer generating units there is additional flue gas environmental clean up equipment requiring staff). This will secure the on-going employment for both existing and new staff.

In addition, the existing station at Kingsnorth recruits 2-3 apprentices each year from the local schools. The successful development of Kingsnorth units 5 and 6 will mean that this number will at least continue and potentially increase for the foreseeable future. In addition to recruiting apprentices E.ON UK is doing a lot to encourage young engineers in the UK. E.ON UK is working to support teachers and encourage children to consider engineering as a career choice. The company also has one of the leading graduate training schemes in the industry.

Policy EP4: Locations of Strategic Importance for Business, Industrial or Distribution Uses (part)

In contributing to the provisions of Policy EP2 the safeguarding and implementation of the following strategic employment locations will have priority:

- *Medway: Kingsnorth and Grain*

This proposed development secures future employment at Kingsnorth.

Policy TP15: Development Traffic and Heavy Goods Vehicles (Part)

Development which generates significant increases in traffic, especially heavy goods vehicles, will not be permitted if it is not well related to the primary and secondary road network, or if it would result in a significant increased risk of crashes or traffic delays unless appropriate measures to mitigate the effect of the development have been secured.
Mitigation measures have been identified to minimise the environmental impact of road transport during construction.

Policy NR2: Energy Generation

Proposals for energy generation will be assessed by the local planning authorities in terms of:

- *Their impact on landscape and nature conservation, health, built environment, air quality, atmosphere (including the level of emissions) and water resource interests; and*
- *the effectiveness of proposed mitigation measures; and*
- *the proximity of proposals to the energy source and their contribution to meeting the energy needs of local communities; and*
- *the prospective life of energy plants and, where appropriate, the site restoration measures proposed.*

The proposal to construct units 5 and 6 has been supported by this Environmental Statement which analyses the environmental effects of the construction and operation of the development, and proposes mitigation measures to reduce impacts to an acceptable level. The proposed new units will have lower environmental impact than the existing plant and will extend the operational life of the station to meet the energy needs of the community. It is in close proximity to existing fuel transport arrangements and the transmission network

Policy NR5: Pollution Impacts

The quality of Kent's environment will be conserved and enhanced. This will include the visual, ecological, geotechnical, historic and water environments, air quality, noise and levels of tranquillity and light intrusion.

Development should be planned and is designed to avoid, or adequately mitigated, pollution impacts. Proposals likely to have adverse implications for pollution should be the subject of a pollution impact assessment.

In assessing proposals and local authorities will taking into account:
a) impact on prevailing background pollution levels; and
b) the cumulative impact of proposals on pollution levels; and
c) the ability to mitigate adverse pollution impacts; and
d) the extent and potential extremes of any impacts on air quality, water resources, biodiversity and human health.

Development which would result in, or significantly contribute to, unacceptable levels of pollution will not be permitted.

This Environmental Statement addresses these issues

Policy NR8: Water Quality

Development will not be permitted where it would give rise to an unacceptable impact on the quality or yield of Kent's watercourses, coastal waters and/or groundwater resources.

Currently Kingsnorth power station abstracts groundwater from local boreholes jointly with Grain power station. E.ON recognises the shortage of water in the South East and proposes to use desalination plant to provide process water for the new units. The proposed development will not lead to an unacceptable effect on the quality or potential yield of groundwater resources.

Policy NR10: Development and Flood Risk (Part)

Development will be planned to avoid the risk of flooding and will not be permitted:

(i) if it would be subject to an unacceptable risk of flooding or where it would increase the risk of flooding elsewhere;

(ii) where it would prejudice the capacity and integrity of flood plains or planned flood protection or coastal defence measures;:

(iii) where it would hinder the implementation of future flood protection or coastal defence measures;

(v) if it would adversely affect the ability of the land to drain.

Groundwater and surface water protection will be ensured throughout construction and operation of units 5 and 6. During construction the implementation of an environmental management plan and project management will ensure that harmful pollutants will not infiltrate ground water resources or contaminate surface water. The design of the plant and operational management will ensure that infiltration will not occur during its operational life.

1.3.5 Medway's Local Transport Plan 2006-2011

The Medway's Local Transport Plan confirms that the A228 Phase 1 improvements, essentially the duelling between Main Road and Roper's Lane, are now complete.

The Transport Plan refers to policies contained in the Regional Planning Guidance for the South East (RPG9). Policy T7 of the governments proposed changes to RPG9 state that:

The appropriate and sustainable development of seaports, port facilities (including access) should be supported for both international and short sea movements.

Policy T8 of RPG 9 states:

A fully integrated freight distribution system should be promoted which makes the most efficient and effective use of road, rail, inland waterways and coastal shipping.

During construction of units 5 and 6, road transport will be predominant means of transport, although it is possible that some large components may be brought in by sea using the existing local unloading facilities.

Once constructed and in operation, road traffic will continue to be used as at present for the removal of ash. River transport will be used for the delivery of coal and limestone and for the removal of gypsum.

The proposals for the construction and operation of units 5 and 6 are therefore consistent with the objectives of the Medway's Transport Plan.

1.4 Environmental Statement

The *Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000* provide that an Environmental Statement (ES), in relation to an application for extension to a generating station of greater than 300MWth (megawatts of thermal energy), must be produced before the Secretary of State can grant consent under Section 36 of the *Electricity Act 1989.* The object of this Environmental Statement is to identify, examine and assess the likely impacts of the Kingsnorth units 5 and 6 on the environment.

The Regulations implement the European *Council Directive 85/337/EEC* on the a*ssessment of certain private and public projects on the environment*. This applies to applications to extend electricity generating stations.

The *Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000* require that certain information is provided by the Environmental Statement ("the specified information"). This information is identical to that required by the C*ouncil Directive 85/337/EEC.* The required information is given in the list below:

(a) A description of the development proposed, comprising information about the site, the design and size or scale of the development;
(b) The data necessary to identify and assess the main effects which the development is likely to have on the environment;
(c) A description of the likely significant impacts, direct and indirect, on the environment, explained by reference to its possible impact on -
    human beings;
    flora;
    fauna;
    soil;
    water;
    air;
    climate;
    the landscape;
    the inter-action between any of the foregoing;
    material assets;
    the cultural heritage;
(d) Where significant effects are identified with respect to any of the foregoing, a description of the measure envisaged in order to avoid, reduce or remedy those effects; and
(e) A summary in non-technical language of the information specified above.

In addition, the Environmental Statement should include by way of explanation or amplification of any specified information, further information on the main characteristics of the development and process, types and quantities of emissions, the main reasons for choosing a site and the technology and predictive tools used in the assessment or uncertainties in the results.

As part of the whole consent process, a Scoping Document was produced and issued to various parties to enable comment and approval of the scope of the Environmental Impact Assessment. A copy of this Scoping Document can be found in Appendix A. The parties consulted in this process were:

- Environment Agency
- Kent County Council
- Medway Council
- The Countryside Agency
- English Heritage
- Natural England
- The Royal Society for the Protection of Birds
- Kent Wildlife Trust
- Hoo Parish Council
- Medway Ports Authority

Any comments made by the parties above have been incorporated into the scope of the Environmental Impact Assessment, and a summary of some general comments can be found in Appendix B.

E.ON UK has undertaken, and will continue to undertake, appropriate consultation throughout the consenting process. These have included:-

- Discussions with statutory consultees prior to issuing the Scoping Document (Natural England, Environment Agency, Medway Council, Hoo Parish Council)

- Writing to all addresses in the Peninsula Ward of Medway (nearly 6000) at the time of issuing the Scoping Statement to inform the local community of what was happening

- Setting up a freephone helpline and website www.eon-uk.com/supercritical

- Meeting with Hoo Parish Council to discuss the proposal in some detail

- Holding a public exhibition for local residents with briefing materials prior to submission of the application for the Section 36 consent

Future events will include:-

- Further public exhibitions in the surrounding communities

- A newsletter updating the local communities on the progress of the project

- Briefing Medway Councillors

- Further meetings with interested stakeholders as appropriate

2 The Site and the Project

2.1 The Site

2.1.1 Introduction

Kingsnorth power station is one of several large coal-fired power stations built by the Central Electricity Generating Board (CEGB) during the 1960s and 1970s. It consists of 4x485MW coal fired generating units; each unit takes its supply of cooling water directly from the River Medway. The power station is located on approximately 400 acres of reclaimed marshland on the north shore of the River Medway, of which approximately 70% is classed as operational land and is occupied by the existing power station buildings and structures, the associated coal and oil storage areas, the coal handling plant or the ash disposal areas.

It is proposed that E.ON UK will replace the 4x485MW sub-critical coal-fired units with two 800MW supercritical coal-fired units, namely Kingsnorth units 5 and 6. The two new units will be built on non-operational land directly to the north of the existing units.

The total land holding, operational site boundary and proposed Section 36 application area are shown in Figure 2.1.1.

2.1.2 Location

Kingsnorth power station site is located near to the village of Hoo St Werburgh, approximately 11km north east of Rochester, Kent. The Ordnance Survey grid square reference for the existing station and the proposed new plant location is given as TQ8172.

The Section 36 Application Area for the proposed new units is shown in Figure 2.1.1. When built, the new units will occupy a small area of approximately 14 ha in size, adjacent to the north of the existing station and will be contained within the present E.ON UK landholding. Additional land will be required during the construction phase for contractors' working areas and storage and this has also been accounted for within the proposed Section 36 Application Area.

All plant falls inside the original Section 2 Consented Area for the existing station and will be built on non-operational land within the E.ON UK landholding at the Kingsnorth site. The entire site falls within the unitary authority of Medway Council in the County of Kent.

2.1.3 Access to the Site

Road access to Kingsnorth power station is via the A228 and a local road (Roper's Lane) leading to the main site access road.

During the construction phase of the project, it may be required to bring abnormal loads into the site by water via the existing "roll on-roll off" (Ro-Ro) berth facility.

2.1.4 General Description of the Site

The power station complex and lands are bordered on three sides by areas designated as Special Protection Areas (SPAs) and Ramsar sites, with only the northern boundary of the site free of this status, where it adjoins Damhead Creek power station to the north-west and Kingsnorth Industrial Estate to the north east.

The existing main power station buildings and operational areas are located generally in the eastern area of E.ON UK's Kingsnorth land holding and the coal stockyard, the oil storage tanks and the ash lagoons are located to the east of the main station complex. Roper's Lane and the main station access road are located to the north east of the site. The land is basically low lying and flat, situated directly adjacent to the north shore of the River Medway from which the existing power station abstracts cooling water. The condenser cooling water (CW) is subsequently discharged from the site via Damhead Creek. The site is protected by a flood barrier running along the site perimeter, behind which is a purpose made drainage channel to further negate the risk of flooding.

The Long Reach jetty projects into the River Medway, south of the main station complex and the coal stockyard.

The site for the proposed new units is located immediately adjacent to the north of the main power station buildings, and is bounded by the flood protection boundary and Damnhead Creek power station to the north, Damhead Creek and the SPA to the east, and the existing station to the south.

2.1.5 Site History

Prior to the construction of the existing Kingsnorth power station, the site, on the north shore of the Medway Estuary, was low-lying marshland. The construction of the power station resulted in the loss of at least 100 hectares of grazing marsh, although the ash lagoons were temporarily retained as marshland whilst the station was predominantly oil-fired. The power station landholding is presently in the region of 400 hectares.

Construction of Kingsnorth power station took place during the late 1960s and early 1970s and required extensive piling for foundation purposes, with other ancillary works, including the construction of the Long Reach and Oakham Ness jetties. Longreach Jetty was modified during the early 1990s to accommodate improvements in the coal conveying plant. The location of Long Reach jetty is shown on Figure 2.1.1; Oakham Ness jetty is located between the Kingsnorth and Grain sites, and is currently used for the delivery of fuel oil to both Kingsnorth and Grain power stations.

2.2 Choice of Kingsnorth for new Supercritical Coal-fired Power Plant

2.2.1 The need for new power stations

- The UK will have a significant supply/demand gap in coming years, especially as existing power stations come to the end of their useful life.

- Even with advances in energy efficiency, distributed generation, etc. there is still a requirement to replace existing large power stations.

- Importing a significant proportion of electricity from other countries would make the UK reliant on other countries for one of the fundamental building blocks of the economy and society.

- Therefore it is prudent for a country to be self-sufficient in generation capacity. Additionally the transport of electricity over long distances leads to losses.

- As a generator of 10% of the UK electricity and with the need to replace 3GW of generating plant, E.ON UK is undertaking many projects to fill the supply/demand gap.

2.2.2 The choice of coal-fired power plant

- In the same way that the UK does not want to be reliant on imported electricity neither does it want to be reliant on one fuel soruce for electricity generation.

- Therefore the UK must have a diverse supply of fuel sources for the replacement electricity generation capacity that has to be built, such as renewables, gas and coal. This is particularly important as the UK becomes an importer of natural gas as North Sea reserves decline.

- E.ON UK is already investing in new gas-fired generation capacity such as the two projects planned at Grain and Drakelow.

- E.ON UK operates 190MW of renewable wind and 56MW of hydro generation.

- E.ON UK co-fires renewable biomass at two of its three coal-fired power stations.

- E.ON is investing in a 50MW dedicated biomass plant at Lockerbie with a similar scheme being considered in the South East of England.

- E.ON UK is planning demonstration projects for new technologies that show promise for the future, including marine renewables and coal gasification with carbon capture and storage.

- E.ON is funding research and development at a number of UK Universities into projects that show promise further into the future.

- E.ON UK proposes to build coal-fired power generating units to ensure that there is adequate fuel diversity, but they must be more efficient than those they replace and must be capable of being retrofitted with additional clean-up technologies as they become available and proven.

2.2.3 The choice of the Kingsnorth site

The decision to replace the existing 4x485MW coal-fired units at Kingsnorth with two new 800MW supercritical coal-fired units was made following extensive investigations by E.ON UK in order to determine the prefered location for new coal-fired plant in the UK. Supercritical plant was preferred to the older sub-critical plant as it offers higher operating efficiencies, resulting in less GHG and other emissions per unit of energy generated, making it a better environmental option.

Important drivers that contribute to the geographical positioning of a new coal-fired plant, such as proximity to a connection point for the electricity network and proximity to suitable cooling water and coal supply have been duly considered, along with a view to re-use of existing assets wherever possible. There is existing access for all these at the Kingsnorth site and there are suitable customers in the general locality for the byproducts.The Kingsnorth site also has suitably sized portion of land available within the existing E.ON UK land holdings which could house the main supercritical coal-fired plant. There will also be suitable land available, once the existing station is demolished, to accommodate carbon capture and storage plant together with suitable routes to the North Sea, should a future legislative framework allow and support this.

Other options have been explored for the site but are deemed as less suitable. For example there is no gas infrastructure on the site and it is not of sufficient land area for wind generation. The existing units could have had flue gas desulphurisation plant fitted to allow operation post 2015 but this would not have addressed reducing CO_2 emissions.

The main factors considered in the site selection process included the following:

- **Proximity to the electricity infrastructure:** a new substation will be built within the power station site adjacent to the existing substation. This will negate any requirement for new overhead transmission lines

- **Re-use of existing site 'assets':** In order to maximise the opportunity for sustainability, it is proposed to re-use the cooling water structures, such as the make-up water pump house and underground culverts where practicable. It is also proposed that the coal import jetty, existing coal stockpile and transfer infrastructure will be re-used for the new units. This may be reviewed and the overall site layout optimised once the existing units have been demolished. Other site infrastructures, such as the road network and surface drainage systems, which will remain in place even following the demolition of the existing units are considered to be suitable for re-use.

- **Proximity to an existing cooling water supply:** The Medway Estuary is suitable for providing the cooling water source for the new units.

- **Proximity to established transport infrastructures:** The impacts of construction and operational road traffic are considered in detail in Section 3.7. However, the proximity to existing road networks is considered advantageous.

- **Available space within the landholding:** There is sufficient non-operational land within the land holdings on the Kingsnorth site to house the supercritical coal-fired plant.

- **Deficit of generation in the South East:** The site benefits from favourable electricity network charges due to the current deficit of generation plant in the area. A development in this area will help to reduce transmission losses in the National Grid Transmisison system by locating new generation capacity closer to the area of demand. A reduction of transmission losses will have a positive effect on the environment by improving the overall efficiency of delivering power to the end user.

- **Experienced workforce:** There is an existing skilled workforce experienced in the operation of coal-fired generating units which can be transferred to operate the new units.

The area for the proposed new units is shown in Figure 2.1.2. The final site layout will be determined by the plant contractor, in agreement with E.ON UK.

2.3 Existing Generating Units at Kingsnorth

The existing Units 1 to 4 will be limited under the Large Combustion Plant Directive legislation to 20,000 hours operation from January 2008 and must close by end of 2015 at the latest. It is proposed that following completion and proven operation of the new Units 5 and 6, the existing Units 1 to 4 will be decommissioned and subsequently demolished. The demolition of the existing units and future use of land which is not required for the operation of the new units will be the subject of separate consultations and planning process in due course. This aspect is therefore not included in this application to construct the new units.

2.4 Power Generation Concepts

2.4.1 Introduction

In a thermal power plant, the objective is to convert energy present in the raw fuel into useful electrical energy for use in homes, businesses and industry. In achieving this objective there are a number of fundamental issues to consider. These include:-

- Maximising efficiency
- Minimising emissions
- General environmental issues

The efficiency of the plant can be described in simple terms as *'the ratio of electrical energy out to the fuel energy in'*. All other things being equal, the more efficient a power plant is, the lower the emissions of gases to the atmosphere per unit of electricity produced.

A supercritical coal-fired generating plant offers higher efficiencies and lower emissions, as compared to a typical sub-critical plant like, for example, the existing Kingsnorth power station. To understand the concepts behind these plants, it is helpful to consider first how conventional thermal power plants such as the current station operate.

2.4.2 Conventional Thermal Power Plant

Fuel is introduced into the boiler where it is mixed with air and burnt. Steam is raised in the boiler and passed into a steam turbine which provides the motive power to drive the generator. Steam exhausting from the steam turbine is condensed back into a liquid by means of cooling water (CW) passing through a condenser. This condensate is then returned back to the boiler.

If the power station is located on a coastal estuary (as is the case at Kingsnorth), the CW is usually abstracted from the estuary, passed through the condenser and is then discharged directly back at a slightly higher temperature than at abstraction. The intake and discharge structures are positioned so as to ensure that the warmer seawater is not recirculated back through the condenser system.

Where the direct cooling method is not possible but a source of “make up” water is available, CW is circulated through cooling towers before returning to the condensers in a closed loop. The cooling towers require a quantity of make up water to replace the water lost through evaporation and to prevent a build up of scale or dissolved solids in the system. The make up water is normally abstracted from a river. Because the CW is continually circulated through the condenser and cooling tower system, it is at a higher temperature than in the direct cooled system, and hence reduces the performance of the steam turbine.

Where an adequate source of CW or make up water is not available, the exhausted steam from the steam turbine is condensed using an air cooled condenser (ACC). The ACC structure is a large radiator bank comprising finned tubes, to which the steam is exhausted directly from the turbine. Air is forced over the radiator banks using a large number of electric fans, cooling the steam so that it condenses. The condensed process water is then returned to the boiler for re-use. The performance of the steam turbine is lower using an ACC arrangement when compared to the CW based cooling system, as the lowest temperature that can be achieved in the ACC is limited to the “dry bulb” air temperature. Plants using an ACC are also subjected to large fluctuations in efficiency due to seasonal ambient air temperature variations.

All of the existing coal-fired power stations in the UK, including the existing units at Kingsnorth, are of sub-critical design and achieve efficiencies of 35-38% depending upon their age and specific design. Where the CW is directly abstracted and discharged to an estuary (as at Kingsnorth) the efficiency is towards the top end of the range, but are unlikely to exceed 37%, especially in plant which has seen extensive operation. If the CW is circulated through cooling towers the efficiency would be lower, and if an ACC is used the efficiency would be lower still.

2.4.3 Supercritical Coal-Fired Plant

The energy production process for super-critical coal-fired power plant is much the same as that for conventional thermal power plant, the main difference between the two is in the boiler design.

The boilers for power generation are either "drum" or "once-through" types, referring to how water is circulated to cool the tubing that forms the furnace enclosure. “Drum” boilers are used in traditional coal-fired thermal generating plant and “once through” are used in supercritical coal-fired plant.

In a boiler, heat is transferred through the tubes that form the furnace enclosure and into the water passing through them, to generate steam to drive the turbine. In drum-type units, the steam flowrate is controlled by the fuel-firing rate. Superheated steam temperature is determined by properly sizing the superheater heat transfer surface, and is controlled by spraywater. In a once-through type boiler, the steam flowrate is established by the boiler feed-water pump and the superheat steam temperature is controlled by the fuel-firing rate.

Since the once-through boiler does not rely on the density difference between steam and water to provide proper circulation and cooling of the furnace enclosure tubes, it can be operated at supercritical (more than 220bar / 3,200psia) pressures. Under the increased pressure conditions the steam and water reach a supercritical state, i.e. they form one homogeneous fluid, therefore the two phases do not need to be separated as in conventional drum boilers, which wastes energy by re-circulating the condensed water, therefore reducing the efficiency of the process.

A typical Advanced Supercritcial Coal pulverised fuel coal plant can offer efficiencies of 45% and can be as high as 47%, if sea water cooling is employed, as is proposed in this case.

2.5 The New Units at Kingsnorth

2.5.1 Introduction

This Section considers in more detail the technical design of the proposed Kingsnorth units 5 and 6. The detailed design of the plant will be carried out by the contractors chosen for the design, construction and commissioning of the plant.

As the detailed design is currently unavailable, the information contained here forms an overall description of the envisaged plant and its operation, based on the understanding and experience gained by Power Technology in the area of supercritical boiler design.

The final plant configuration will not be materially different from that described and any changes will not have a significant impact on the environmental analysis.

2.5.2 Outline of Proposed Plant

2.5.2.1 Foundations

Historic and recent ground investigation analyses indicate that the site is considered to have adequate ground conditions, although some further limited investigations may be necessary.

2.5.2.2 Temporary Contractors' Work Area (Laydown)

In general, an area approximately equal to that of the final development will be necessary for the purposes of fabrication, storage and site facilities such as contractors' accommodation, etc. during the construction period.

The laydown areas will be located as close to the site as practically possible. Other suitable land for potential use during the construction phase has been identified, just north of the existing site boundary. All of the required land is included within the Section 36 Application Area shown on Figure 2.1.1.

2.5.2.3 Plant Specifics

The new units will be based on steam conditions of 280-300bar, 600°C at the high pressure (HP) steam turbine inlet with reheat to 620°C (i.e. 280-300bar/600°C/620°C). These are widely agreed to be the current state-of-the-art steam conditions that would be offered by a number of suppliers for supercritical units fired on hard coal to be built in the near future. However the exact steam conditions will depend upon the detailed design process for the site.

Greater operating efficiencies mean that less coal is required per unit of electricity generated. The benefits realised as a result of this are:

- natural resource savings

- reduction in production of air borne emissions, i.e. carbon dioxide (CO_2), sulphur dioxide (SO_2), dust (particulates(PM10)), oxides of nitrogen(NO_x)

A one percent increase in efficiency will reduce by two percent the specific emissions listed above. In particular the supercritical plant will reduce CO_2 emissions by 1.2million tonnes, as compared with subcritical units of the same energy output. It is thought that this will play an important role in supporting the UK government in meeting its emissions reduction targets under the Kyoto protocol.

2.5.2.4 Typical Buildings / Plant

The new power plant will consist of two 800MW generating units, which will each include a supercritical boiler and steam turbine, housed in separate buildings. The plant dimensions will depend on the contractor finally chosen. The boiler house dimensions are expected to be around 64m wide, 66m long and 110m high and the turbine house dimensions around 37m wide, 47m long and 63m high. Each generating unit will discharge its flue gas through a chimney stack, which is expected to be around 198m high, the same as the existing stack height. The exact height willl be determined by emissions modelling when specific plant design parameters are available, ensuring that permitted ground level concentrations are not exceeded. silos for limestone, gypsum and temporary ash storage will also be located on site; they are expected to be approximately 35 m high.

The units are expected to be located in a side-by-side configuration, as represented in Figure 2.1.1. An indicative arrangement of the new units is shown in Figure 2.1.7.

The proposed station will also require a desalination plant to provide make-up water to the boilers; the desalination plant will also require two water storage tanks. The dimensions of the desalination plant are expected to be 20m wide, 30m long and 10m high, the dimensions of the tanks are expected to be 22m dia and 16m high. Further water storage will also be required for a supply of townswater for potential fire fighting purposes; the storage tank is expected to be 10m dia and 15m high.

Two 50 MW oil-fired, gas turbines (GTs) are also proposed to be built on the site to enable the super-critical coal-fired plant to be started in the event that it should become isolated from the grid. This black-start provision is an important part of preserving security of supply and replaces that provided by the existing gas turbine units. The GT buildings are expected to be around 15m wide 17m long and 11m high, with stacks of approximately 40m high. The GTs will be fed oil from storage tanks on site, which will be approximately 22m in diameter and 16m high.

The supercritical coal-fired generating plant will also be fitted with flue gas cleaning equipment in line with current legislation, which will consist of:

- Selective Catalyic Reduction (SCR) for removal of oxides of nitrogen

- Electrostatic precipitators (ESPs) for removal of pulverised fuel ash (pfa or particulates)

- Flue Gas Desulphurisation (FGD) for the removal of oxides of sulphur

2.5.2.5 The Environmental Equipment

Electrostatic Precipitators

The precipitator basically contains a row of thin wires, followed by a stack of large flat metal plates; the plates are typically spaced about 1 cm apart. The air stream flows through the spaces between the wires, and then passes through the stack of plates.

A high-voltage power supply transfers electrons from the plates onto the wires, developing a negative charge of several thousand volts on the wires, relative to the positive charge on the plates.

As particulate matter is carried past the strong negative charge on the wires, the particulate matter picks up the negative charge and becomes ionized. The ionized particles then move past the positively charged plates, to which the ionized particles are strongly attracted.

Once the particles are in contact with the positive plate, they then give up their electrons and become positively charged like the plate, and thus start acting as part of the collector.

The collector plates are automatically rapped at spaced intervals with a hammer to clear the particulates, which then collect in a hopper at the bottom of the funace. The ash will be collected from the hopper and stored temporarily in silos on site, before sale to a suitable customer by tanker.

The SCR Process

A vanadium titanium catalyst material is used as the surface for the NOx reduction reactions, which allows it to occur in a lower temperature range, typical of those seen at the economiser outlet (300-400°C). A simplified diagram of a typical SCR system is shown in Figure 2.1.8.

Ammonia is used as a reagent and is injected into the flue gases via a matrix of injection nozzles (known as an Ammonia Injection Grid or AIG) or via larger nozzles in concert with arrangements of static mixers.

The reagent is usually vaporised and then mixed with a carrier medium prior to injection, this provides primary dilution of the ammonia and improves penetration into the flue gases. It is common for pre-heated air to be used as the carrier gas. After injection of the reagent into the flue gas the mixture then passes over catalyst beds mounted in a reaction chamber installed in the flue gas stream. Here the NOx reduction reactions occur and ammonia and NOx react to form molecular N_2 and H_2O.

The DENOx chemical reactions can be written as:

$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$
$6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O$

Current SCR technology is up to 90% effective at removing NO_x from the flue gas stream.

The main SCR arrangement commonly used in coal-fired plant employs a reactor chamber at the economiser outlet, before the airheater.

The FGD Process

In the limestone gypsum wet scrubbing process, the flue gas is treated with limestone (calcium carbonate) slurry in order to capture and neutralise SO_2. The final product is calcium sulphate dihydrate (gypsum).

The overall reaction is:

$$CaCO_3 + SO_2 + ½O_2 + 2H_2O \rightarrow CaSO_4.2H_2O + CO_2$$

Dry crushed limestone will, under normal operating circumstances, be imported to the power station by barge and initially transferred to a limestone storage building by covered conveyor. It will then be transferred to a limestone mill building, again by conveyor. In this building, the limestone will be ground in mills and mixed with water to produce a limestone slurry. The slurry will then be pumped into storage tanks, which in turn supply the absorber towers. Passage of materials between limestone slurry storage tanks and the absorbers will be by conveyors.

A simplified diagram of a typical FGD system is shown in Figure 2.1.9. Flue gas from the electrostatic precipitator (ESP) is drawn through the induced draught (ID) fan and normally through a booster fan before reaching the gas heat exchanger. The purpose of the heat exchanger is to absorb heat from the raw untreated flue gas, before it passes to the absorber where it will be cooled by contact with the recirculating slurry. The heat absorbed by the gas heat exchanger is then used to re-heat the treated flue gas exiting the absorber.

Within the absorber the untreated flue gas comes into direct contact with the limestone slurry, where some of the slurry water is evaporated and the gas cooled further. The gas is scrubbed with the recirculating limestone slurry, removing the required amount of sulphur dioxide (SO_2). The level of SO_2 removal in the absorber ensures that a concentration of no more than 200mg/Nm^3 of SO_2 is emitted from the unit.

The process also removes almost 100% of any hydrochloric acid (HCl) in the flue gas entering the absorber. At the top of the absorber, the gas passes through two stages of demisters to remove small water droplets before passing back through the outlet side of the gas heat exchanger where it is reheated to increase the buoyancy of the treated gas exiting the stack. The gases will be discharged into the atmosphere through the existing chimney.

The plant will have a bypass duct that will be used during start-up to protect the absorber internals from excessive temperatures, and may be opened rapidly to allow flue gas to be diverted past the FGD plant, directly to the chimney, in the event of an emergency. During operation the bypass duct may be partially open to meet the operational design characteristics of the FGD plant.

The reaction inside the absorber vessel produces gypsum (calcium sulphate) which crystallises in the absorber sump. The gypsum is pumped to a dewatering building where the water content of the gypsum is reduced to less than 10%. The gypsum is then transferred by a covered conveyor to a storage facility, from where it can be then conveyed to the vessel loading facility.

The water required for the FGD process will be obtained from a new seawater desalination system to supply process water of the required quality to the FGD plant. The efficiency of the FGD process decreases as contaminants build up in the system, and so a continuous purge is required to maintain a high efficiency. This process water, along with other wastewater from the FGD system is passed through a wastewater treatment plant before being discharged into the station's effluent system, and ultimately into the Medway Estuary via Damhead Creek.

2.6 Construction

E.ON UK has a considerable experience of large generating plant construction and retrofit projects, and has successfully undertaken the role of Owner's Engineer for many construction projects for E.ON UK and also on the behalf of external customers both in the UK and overseas.

A dedicated project management team of experienced E.ON UK employees will oversee the construction of the power station to ensure that all works are being carried out in a safe, efficient and proper manner.

The management team will ensure that all works take place in accordance with the requirements of any consents, licences, authorisations or permission granted to E.ON UK plc for the development.

Typical construction activities include:

- Site preparation – to create construction laydown and working areas.
- Piling – to create the main plant foundations.
- Civil engineering – to create further foundations, buildings, services, roads etc.
- Steel erection – of structural steel frameworks.
- Mechanical plant – locating plant and equipment, etc. on foundations in the main plant area and conveyors from the coal stockyard and at the sorbent offloading/gypsum loading area, using a range of cranes and mobile plant. There will also be on-site assembly of tanks, storage vessels and fans.
- Electrical and control – Installation of electrical cables, equipment, and control and instrumentation systems.

During the peak of construction activities it is anticipated that for a short period up to around 3300 construction workers will be required at the site. This is ultimately dependent upon the contractors appointed by E.ON UK plc to construct the new power plant. However, as only a few of these workers will be specialists, many of the construction labour could be sourced locally. This will have a beneficial effect both directly and indirectly on local employment, especially during the construction period. More details are given in Section 3.9.

Subject to the granting of all relevant consents and licences for the construction of the proposed power plant, the earliest date expected for initial construction works to commence on site would be in 2008. On this timescale, the proposed power plant could commence operation of the first unit by early 2012.

3 Environmental Impact Assessment

3.1 Air Quality

3.1.1 Introduction

An atmospheric dispersion model has been used to asses the impact on air quality of the proposed Kingsnorth supercritical plant.

Ground level concentrations predicted by the model are combined with estimates of background ground level concentrations based on monitoring data and compared with the relevant air quality standards.

3.1.2 Air Quality Standards

The Air Quality Strategy for England, Scotland, Wales and Northern Ireland (DETR and the devolved administrations, 2000) set out air quality objectives for sulphur dioxide, nitrogen dioxide, fine particles (PM_{10}), carbon monoxide (CO) and other substances. In addition, the World Health Organisation has issued a guideline value of 50µg/m^3 for annual mean sulphur dioxide concentrations. Health-based objectives relevant to this study are shown in Table 3.1.1.

Following a review and public consultation in 2001, an Addendum to the Strategy was issued earlier this year (DEFRA and the devolved administrations, 2003) which introduced tighter objectives for fine particles (PM_{10}). The Addendum notes that the objectives for particles should be regarded as provisional and are likely to be subject to change by future modification of the Air Quality Strategy. These tighter objectives for Wales and England (except London), i.e. the objectives applicable to the Kingsnorth study area, are shown in Table 3.1.2. DEFRA and the devolved administrations are currently consulting on a review of the Air Quality Strategy (DEFRA and the devolved administrations 2006).

Technical Guidance Note H1 lists environmental benchmarks for the protection of vegetation and ecosystems. These consist of national objectives for nitrogen oxides and sulphur dioxide for the protection of vegetation and ecosystems as set out in the Air Quality Strategy (DETR and the devolved administrations, 2000). The benchmarks are shown in Table 3.1.3.

Table 3.1.1: Air Quality Standards for the protection of human health

Substance	Objective		Date to be achieved by
	Concentration	Measured as	
Sulphur dioxide	350µg/m^3 (132ppb)	1 hour mean not to be exceeded more than 24 times a year (99.73rd percentile)	31 December 2004
	125µg/m^3 (47ppb)	24 hour mean not to be exceeded more than 3 times a year (99.18th percentile)	31 December 2004
	266µg/m^3 (100ppb)	15 minute mean not to be exceeded more than 35 times a year (99.9th percentile)	31 December 2005
	50µg/m^3 (19ppb)	Annual mean	Not applicable (WHO guideline value)
Nitrogen dioxide	40µg/m^3 (21ppb)	Annual mean	31 December 2005
	200µg/m^3 (105ppb)	1 hour mean not to be exceeded more than 18 times a year (99.79th percentile)	31 December 2005
Particles (PM_{10})	50µg/m^3	24 hour mean not to be exceeded more than 35 times a year (90.41th percentile)	31 December 2004
	40µg/m^3	Annual mean	31 December 2004

Table 3.1.2: Provisional Air Quality Standards for fine particles (PM_{10})

Substance	Objective		Date to be achieved by
	Concentration	Measured as	
Particles (PM_{10})	50µg/m^3	24 hour mean not to be exceeded more than 7 times a year (98.08th percentile)	31 December 2010
	20µg/m^3	Annual mean	31 December 2010

Table 3.1.3: Air Quality Standards for the protection of vegetation and ecosystems

Substance	Objective / Critical Level		Date to be achieved by
	Concentration ($\mu g/m^3$)	Measured as	
Nitrogen oxides	30	Annual mean	31 December 2000
Sulphur dioxide	20	Annual mean	31 December 2000
	20	Winter mean (1 Oct to 31 March)	31 December 2000

Note that the AQS objectives for the protection of vegetation and ecosystems are only intended to apply at locations that are:

- More than 5km from a process such as the proposed plant, regulated under Part A of the Environmental Protection Act 1990;
- More than 20km from an agglomeration, which is defined as an area with a population more than 250,000;
- More than 5km from motorways; and
- More than 5km from built up areas of more than 5,000 people (DETR, 2000).

3.1.3 Existing (Baseline) Air Quality

Two monitoring sites exist in the vicinity of Kingsnorth. E.ON UK operates a monitor at Gillingham Strand (grid reference 578400, 169300) which records levels of sulphur dioxide, nitrogen dioxide and PM_{10}. NETCEN operate a monitor at a rural site outside Rochester (grid reference 583100,176200), which records levels of sulphur dioxide, nitrogen dioxide and PM_{10}. The location of these monitors relative to the existing E.ON UK Kingsnorth and Grain power stations are shown in Figure 3.1.1.

Long term mean measurements provide an indication of the contribution of all sources (including the existing Kingsnorth power station) to existing air quality. These measurements can be considered in combination with the modelled station contribution presented later in this study to indicate whether air quality standards are likely to be complied with in the modelling scenarios considered.

Annual mean concentrations of sulphur dioxide, nitrogen dioxide and PM_{10} recorded during 2001 to 2005 at these monitoring stations are shown in Table 3.1.4.

Table 3.1.4. Existing (baseline) annual mean concentrations

Substance	Location	Year	Annual mean concentration ($\mu g/m^3$)
Sulphur dioxide	Gillingham Strand	2005	6.5
		2004	4.9
		2003	4.8
		2002	4.4
		2001	7.2
	Rochester	2005	6.1
		2004	6.9
		2003	6.8
		2002	7.0
		2001	8.5
Nitrogen dioxide	Gillingham Strand	2005	23.3
		2004	24.9
		2003	27.6
		2002	24.7
		2001	27.1
	Rochester	2005	18.8
		2004	20.4
		2003	21.8
		2002	21.2
		2001	22.1
Nitrogen Oxides	Gillingham Strand	2005	23.3
		2004	35.9
		2003	43.5
		2002	36.6
		2001	47.5
	Rochester	2005	18.8
		2004	28.2
		2003	30.6
		2002	27.4
		2001	31.1
PM_{10}	Rochester	2005	21.5
		2004	21.0
		2003	24.6
		2002	23.0
		2001	21.1

The annual mean concentrations are currently below the long term AQS target values.

Existing short term concentrations of sulphur dioxide, nitrogen dioxide and PM_{10} recorded in the years 2001 to 2005 at the monitoring sites are shown in Table 3.1.5.

Table 3.1.5. Existing (baseline) short-term concentrations

Substance	Statistic	Location	Year	Concentration ($\mu g/m^3$)
Sulphur dioxide	99.18th percentile of 24 hour mean concentrations	Gillingham Strand	2005	18.4
			2004	17
			2003	20.2
			2002	16.3
			2001	26
		Rochester	2005	17.3
			2004	20
			2003	26
			2002	23.3
			2001	28
	99.73rd percentile of 1 hour mean concentrations	Gillingham Strand	2005	39
			2004	42
			2003	43
			2002	41.0
			2001	49
		Rochester	2005	51
			2004	74
			2003	67
			2002	74.0
			2001	77
	99.9th percentile of 15 minute mean concentrations	Gillingham Strand	2005	66
			2004	61
			2003	62
			2002	65
			2001	63
		Rochester	2005	83
			2004	111
			2003	112
			2002	130
			2001	131
Nitrogen dioxide	99.79th percentile of 1 hour mean concentrations	Gillingham Strand	2005	87
			2004	90
			2003	99
			2002	85
			2001	92
		Rochester	2005	74
			2004	76
			2003	80
			2002	71
			2001	78
PM_{10}	90.41st percentile of 24 hour mean concentrations	Rochester	2005	33.9
			2004	32.4
			2003	39.2
			2002	36.0
			2001	31.4

Note: Gillingham Strand commenced monitoring on the 26th July 2001

3.1.4 Impact Assessment

An atmospheric dispersion model has been used to calculate the proposed plant contribution to ground level concentrations.

3.1.4.1 Model

The atmospheric dispersion model ADMS 3 (Air Dispersion Modelling System) version 3.3 release has been used. ADMS is used extensively by power station operators and the Environment Agency and also by many other industries and consultancies. ADMS was developed by CERC (Cambridge Environmental Research Consultants) and has been verified extensively against measurement (CERC, 2000).

3.1.4.2 Emission characteristics

The emission characteristics for the proposed supercritical plant used in the modelling are shown in Table 3.1.6.

Table 3.1.6: Emission characteristics

Parameter	Proposed new units
Stack A location (m)	581173, 172602
Stack B location (m)	581173, 172442
Stack height (m)	198
Flue Diameter (m)	6.6
Volume flow rate (full load at stack exit conditions) (m^3/s)	848
Stack exit Temperature (°C)	80
NO_x emission rate (g/s)	122
NO_x emission concentration (mg/Nm^3)	200
SO_2 emission rate (g/s)	122
SO_2 emission concentration (mg/Nm^3)	200
PM_{10} emission rate (g/s)	6.2
PM_{10} emission concentration (mg/Nm^3)	10

Note: Emission concentrations are quoted at the relevant reference conditions, i.e. dry, 273K, 101.3kPa, 6% v/v O_2 dry.

The plant is assumed to have two stacks labelled A and B. In the model the scenario is represented by the plant running full load continuously throughout the entire year, although in practice the expected annual utilisation factor is no more than 80%.

The NO_x and SO_2 emission concentrations are based on LCPD limit values for new plant, both of $200mg/Nm^3$.

3.1.4.3 Other Model Inputs

Five years of hourly sequential meteorological data from Manston were used in the dispersion modelling. This is the closest operational meteorological site to Kingsnorth that records all necessary parameters for dispersion modelling. Data recorded during 2001 to 2005 was used.

Ground level concentrations have been calculated on a regular grid of points extending 15km north, south, east and west of the power station. The spacing between points was 500m.

Surface roughness length is a measure of the influence of the surface features on dispersion. A value of 0.2 has been used, which is consistent with the value used in the Air Quality Management plan for the existing Kingsnorth power station and subsequent annual reviews of the Air Quality Management Plan (Lines 2006a).

When modelling the proposed supercritical plant, one building has been considered, as detailed in Table 3.1.7. Note that the two boiler houses have been considered as one large building in the model.

Table 3.1.7 Plant Building Dimensions

	Boiler House
Co-ordinates of building centre	581038,172525
Height (m)	110
Length (m)	149
Width (m)	71
Building Orientation (angle between building length and north) (°)	180

3.1.5 Impact Assessment Results

The model was run with five different years of sequential meteorological data (2001 to 2005) and the maximum predicted ground level concentration (both Process Contribution and Predicted Environmental Concentration) from the five years is shown in Table 3.1.8.

3.1.5.1 Model Predictions of Sulphur Dioxide

The Process Contribution (see Table 3.1.8) for sulphur dioxide at the maximum impact point comprises between 3% and 23% of the appropriate Environmental Assessment Levels. The contribution of other existing sources is represented by an average background SO_2 concentration of 8.5µg/m^3, which is the maximum annual average concentration measured at either of the Rochester or Strand monitoring sites during the 2001 to 2005 period, as discussed in Section 3.1.3.

Taking background concentrations into account the maximum predicted sulphur dioxide ground level concentrations for the proposed plant operating at full load are substantially below the threshold values for all the SO_2 AQS objectives for the protection of human health.

The 99.9th percentile of the 15 minute mean SO_2 Predicted Environmental Concentration is 70µg/m^3 which is 26% of the AQS objective threshold value of 266µg/m^3.

The annual average of hourly mean SO_2 concentrations at the maximum impact point, including background concentration is predicted to be 10µg/m^3 which is 20% of the air quality standard of 50µg/m^3. The background concentration accounts for about 17% of the objective.

3.1.5.2 Model Predictions of Nitrogen Dioxide

ADMS was run using the NO_x as NO_2 emission rate in all scenarios (i.e. the mass emission rate of NO_x is calculated as if all the NO_x is emitted in the form of NO_2). For the proposed plant, approximately 5% of the NO_x at the stack exit point is emitted in the form of nitrogen dioxide (NO_2) while 95% is in the form of nitric oxide (NO). Once

released, NO can be converted to NO_2 by reaction with low level ozone in the atmosphere. The process is also reversible in sunlight and the net rate of conversion of NO to NO_2 in the plume is therefore a complicated function of the rate of dilution of the plume by ambient air, trace gas concentrations in the air and meteorology.

The guidelines from the Air Quality Modelling and Assessment Unit (AQMAU) on conversion rates for NO_x and NO_2 (AQMAU, 2006) have been used for estimating ground level concentrations of NO_2. The Screening/Worst case scenario used in this case is summarised below:

- Short term concentrations (e.g. 99.79th percentile of the hourly mean concentrations) to be estimated assuming 50% of the NO_x emitted from the power plant is in the form of NO_2 at ground level;

- Long term concentrations (e.g. annual average of hourly means) to be estimated assuming all NO_x emitted from the power plant is in the form of NO_2 at ground level.

The NO_2 Process Contributions (ground level concentrations caused by the proposed supercritical power plant) predicted using ADMS without the NO_x chemistry module and then applying the AQMAU methodology are shown in Table 3.1.8. The Process Contribution for the plant operating continuously at full load is significantly below the NO_2 air quality standard for the protection of human health. The NO_2 Predicted Environmental Concentration (PEC) is also shown in Table 3.1.8. The PEC meets both the hourly and annual NO_2 objectives.

The predicted 99.79th percentile of the hourly mean NO_2 concentrations for the proposed supercritical plant operating continuously at full load is shown in Figure 3.1.2. This shows that the maximum predicted ground level concentration occurs approximately 1.2km to the north east of Stack A, while concentrations further from the plant (e.g. 3km away) are substantially less than the maximum concentration. The maximum 99.79th percentile PEC of the hourly mean NO_2 concentration is predicted to be 56µg/m^3 which is 28% of the air quality standard of 200µg/m^3.

At the maximum impact point, the annual average PEC of the hourly mean NO_2 ground level concentrations, using the conservative assumption that all NO_x is released in the form of NO_2, is 29µg/m^3 which is 72% of the air quality standard. Note that 69% of the annual average at the maximum impact point is caused by background concentrations, not by the proposed plant. As mentioned in Section 3.1.3, background concentrations have been calculated via a conservative worst case approach. The maximum impact point is 1.9km to the north east of stack A.

3.1.5.3 Model Predictions of Fine Particles (PM_{10})

The Process Contribution for fine particles (PM_{10}) comprises less than 1% of the relevant Air Quality Strategy objectives for PM_{10}. Taking into account local background concentrations accounting for about 50% of the objectives, the Predicted Environmental Concentrations of PM_{10} comprise less than 62% of the relevant objectives.

Table 3.1.8 Predicted ground level Process and Environmental Concentrations

Substance	Statistic	AQS Objective or EAL	Background Concentration (µg/m^3)	PC (µg/m^3)	PC/ EAL (%)	PEC (µg/m^3)	PEC/ EAL (%)
Nitrogen dioxide	Annual mean (100% modelled NO_x as NO_2)	40	27.6	1.3	3%	28.9	72%
	99.79th %ile of 1 hour mean concentrations (50% modelled NO_x as NO_2)	200	27.6	27.9 [1]	14% [1]	55.5 [1]	28% [1]
Sulphur dioxide	Annual mean	50	8.5	1.3	3%	9.8	20%
	99.9th %ile of 15 minute mean concentrations	266	8.5	61.6	23%	70.1	26%
	99.73rd %ile of 1 hour mean concentrations	350	8.5	53.9	15%	62.4	18%
	99.18th %ile of 24 hour mean concentrations	125	8.5	20.9	17%	29.4	24%
Particulate	Annual mean	40	22	0.1	0.2%	24.6	62%
	90.41th %ile of 24 hour mean concentrations	50	22	0.3	1%	24.6	49%

[1] The prediction for NO_2 is derived from the prediction for total NO_x multiplied by 0.5

3.1.6 Combined Impacts of Kingsnorth and Grain

The combined impacts of the existing Kingsnorth and Grain power stations are included within the monitoring data in Tables 3.1.4 and 3.1.5. Assessment of retrospective emissions and the predicted impact for the following year, both inidividually and in combination, are contained in the Annual Review of the Air Quality Management Plans for the existing Kingsnorth and Grain power stations (Lines 2006a & 2006b). Maximum impacts are not increased by the consideration of both stations in combination, as the maximum impacts of the individual stations do not overlap.

E.ON UK has recently gained Section 36 consent for a 1200 MW CCGT on the Grain power station site. The most recent assessment of possible impacts from the proposed CCGT at Grain is presented in Booth (2006). This shows that maximum impacts from the proposed CCGT are expected to be within 500 m of the proposed CCGT. The maximum impact of the proposed new units at Kingsnorth and CCGT at Grain operating in combination is not expected to be significantly different from the maximum impacts of the two proposed stations considered in isolation.

3.1.7 Other Impacts

3.1.7.1 Plume Visibility

Water vapour will be present in the flue gas emitted from the stacks of the new units. This may cause a white condensation plume to be visible when certain weather conditions exist.

3.1.7.2 Dust During construction

During the construction of the new units, there is the potential for dust to be generated from various activities:

- Demolition and construction of buildings
- Access road construction
- Transportation of materials to and from site by construction traffic
- Soil stripping and earthworks.

Dust from these activities may be generated and transported beyond the site boundary in smaller or greater amounts depending primarily on the wind, moisture content of the material, and its physical properties such as particle size and friability.

Once airborne, the distance the dust is transported is primarily governed by the wind speed and particle size. Smaller dust particles remain airborne for longer, dispersing widely and depositing more slowly over a wider area. Research has shown that large dust particles (greater than about 30µm), that make up the greatest proportion of dust emitted from construction activities and stockpiles will largely deposit within 100m of sources. Dust particles in the size range 10 – 30 µm are typically likely to travel 200m to 500m. Smaller particles than these are not produced in significant amounts from construction activities. The potential for significant dust nuisance is therefore greatest within 500m of the source.

Government guidance (ODPM, 2003) classifies residential areas as being of medium sensitivity to dust impacts. The closest medium sensitivity receptor to Kingsnorth is the isolated dwelling at Burnt House Farm. The dwelling lies more than 500m to the west of the main construction area. At this distance, the potential for significant impacts is small. There are no high sensitivity locations within 1 km of the principal construction activities. The low sensitivity and distance of key receptors from the principal construction activities are such that the probability of significant dust impacts is very small.

However, to ensure the risk of dust nuisance is minimised, the following site management practices will be adopted:

- Sheeting of HGVs carrying loose materials;
- Use of water sprays during hot dry periods to dampen down working areas and roadways;
- Frequent washing of roads and surfaces;
- Wheel washing of vehicles leaving the site when this is likely to otherwise lead to airborne dust.

3.1.7.3 Climate Change

Anthropogenic emissions of carbon dioxide have been identified as playing a major role in Global Warming. The efficiency of the new units will be greater than the plant efficiency of the existing Kingsnorth power station. Thus the new units will emit less CO_2 per GWh of electricity produced than the existing Kingsnorth power station.

3.1.7.4 Photochemical Ozone Creation Potential

In addition to being a greenhouse gas, when present in the lower part of the atmosphere, ozone may be harmful to human health if it is present at a sufficiently high concentration. Thus, although ozone is beneficial in the upper layers of the atmosphere (stratospheric ozone), it may pose health effects when present at ground level. Ozone present at ground level will be referred to in the remainder of this section as "low-level ozone".

Low-level ozone, as a trace gas in the atmosphere, reacts with nitric oxide (NO) leading to the formation of NO_2. In addition, low-level ozone can be generated under some circumstances.

The chemical reactions involving combustion products from power stations and low-level ozone have been studied in detail and measurements have been made of the rates of production/destruction of ozone in power station plumes (e.g. White, 1977; Melo and Stevens, 1981, and Hegg et al, 1977). In the case of power station plumes, the combustion gases will have been diluted to levels undetectable above background after distances of a few tens to one hundred kilometres. Out to such distances, it has been consistently found that the net result of a power station plume is to consume low-level ozone.

The proposed new units do not therefore cause any local increases in low-level ozone.

3.1.8 Conclusions

3.1.8.1 Sulphur Dioxide

Atmospheric dispersion modelling predicts that all the AQS objectives relating to SO_2 will be easily met for the proposed new units operating continuously on full load.

The 99.9th percentile of the 15 minute mean SO_2 Predicted Environmental Concentration is 70µg/m^3 which is 26% of the AQS objective threshold value of 266µg/m^3. Therefore the development does not contribute significantly to the air quality in the area.

3.1.8.2 Nitrogen Dioxide

The Predicted Environmental Concentrations of NO_2 resulting from the new units will be within the AQS limits for NO_2.

For the proposed plant operating continuously on full load, the predicted annual average NO_2 concentration, including background at the maximum impact point is 29µg/m^3, which is 72% of the air quality standard of 40µg/m3.

For the new units operating continuously on full load, the 99.79th percentile of the hourly mean NO_2 concentrations at the maximum impact point, including background concentration, is predicted to be 56µg/m^3, which is 28% of the air quality standard of 200µg/m^3. Therefore the development does not contribute significantly to the air quality in the area

3.1.8.3 Particulate Matter

The Predicted Environmental Concentrations of PM_{10} for the proposed supercritical plant operating continuously at full load are within the AQS limits for PM_{10}. Therefore the development does not contribute significantly to the air quality in the area

References

AQMAU (2006) Air Quality Management and Assessment Unit, Conversion Rates for NO_x and NO_2

Booth V (2006) Further Modelling for the IPPC Application for Grain Power Station Site - Proposed CCGT and Existing Oil Units. Power Technology Report PT/06/BE1340/R.

CERC (2000) ADMS 3 Validation Summary. ED/TS/SP191.

DEFRA and the devolved administrations (2003). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: Addendum, Product Code PB7874

DEFRA and the devolved Administrations (2006), The Air Quality Strategy for England, Scotland, Wales and Northern Island, A consultation document on options for further improvements in air quality, Product code PB11252a

DETR and the devolved administrations (2000), The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Cm4548, SE2000/3, NIA7

Hegg D A, Hobbs PV, Lawrence FR &Harrison H (1977), Reaction of ozone and nitrogen oxides in power station plumes. Atmospheric Environment 11, 521-526.

Lines (2006a) Air Quality Management Plan: Annual Review of 2005 Operations - Kingsnorth Power Station, Power Technology Report PT/06/BE822/R

Lines J M (2006b) Air Quality Management Plan: Annual Review of 2005 Operations: Grain Power Station. Power Technology Report PT/06/BE989/R

Melo O T & Stevens R D (1981) The occurrence and nature of brown plumes in Ontario. Atmospheric Environment 15, 2521-2529

OPDM (2005) Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England, Office of the Deputy Prime Minister, 04PD02993(1)

White H W (1977) NOx-O_3 photochemistry in power plant plumes: comparison of theory with observation. Envir. Sci. Technol. 11, 995-1000.

3.1.9 Impact on Vegetation

This section describes the assessment of the impacts of emissions from the proposed new units at Kingsnorth on local ecologically sensitive sites, specifically Sites of Special Scientific Interest (SSSIs) and 'Natura 2000' sites, designated under the Habitats Directive, lying within 15km of the plant.

3.1.9.1 Local ecologically sensitive sites

Natura 2000 Sites and Ramsar sites located within 15km of the plant are:

- Benfleet & Southend Marshes Ramsar and SPA
- Thames Estuary & Marshes Ramsar and SPA
- Medway Estuary & Marshes Ramsar and SPA
- The Swale Ramsar and SPA
- Queendown Warren SAC
- North Downs Woodlands SAC
- Peter's Pit SAC

The locations are shown in Figure 3.1.9.1

Sites of Special Scientific Interest located within 15km of the plant are:

- The Swale SSSI
- Chattenden Woods SSSI
- South Thames Estuary & Marshes SSSI
- Great Crabbles Wood SSSI
- Queendown Warren SSSI
- Medway Estuary & Marshes SSSI
- Shorne & Ashenbank Woods SSSI
- Peters Pit SSSI
- Northward Hill SSSI
- Halling to Trottiscliffe Escarpment SSSI
- Purple Hill SSSI
- Wouldham to Detling Escarpment SSSI
- Tower Hill to Cockham Wood SSSI
- Cobham Woods SSSI
- Holborough to Burham Marshes SSSI
- Holehaven Creek SSSI
- Mucking Flats & Marshes SSSI
- Vange & Fobbing Marshes SSSI
- Benfleet & Southend Marshes SSSI

There are three additional three SSSIs which are designated for geological features only, and hence require no assessment of power station impacts:

- Houlder & Monarch Hill Pits SSSI
- Dalham Farm SSSI
- Aylesford Pit SSSI

The locations are shown in Figure 3.1.9.2. It can be seen through comparison of Figures 3.1.9.1 and 3.1.9.2 that in many cases the SSSIs are geographically concurrent with the Natura 2000 and Ramsar sites.

3.1.9.2 Modelling methodology for sensitive habitats

The impact of emissions to air has been assessed for all SSSIs, Natura 2000 sites and Ramsars within 15km of the plant.

Potential impacts on sensitive receptors at the local sites include direct effects resulting from concentrations of SO_2 and NO_x, together with the effects related to the deposition of acidity and nutrient nitrogen. Impacts on vegetation and ecosystems are generally long term effects. The modelled emissions scenario is represented by the plant running full load continuously throughout the entire year, although in practice the expected annual utilisation factor is no more than 80%, hence the results represent a conservative approach.

Information related to the sensitivity to air concentrations and acid and nutrient nitrogen deposition of the special interest features has been provided by the Environment Agency in conjunction with English Nature and the Joint Nature Conservation Committee (Whitfield, 2005, Chapman 2005, Environment Agency, 2005a,b,c) for the PPC assessment for the existing Kingsnorth coal-fired plant (Brooke et al., 2006) and the environmental assessment levels provided have been applied for the assessment of the proposed new units.

For the assessment of impacts at sensitive ecological sites, concentrations were predicted using ADMS on a 30km by 30km grid centred on the new units with a grid spacing of 500m. Five years of meteorology were used to ensure that worst case meteorological conditions were captured.

Objectives for the protection of vegetation and ecosystems and critical levels apply to total NO_x (as NO_2) concentrations. One set of model runs was performed using five years of meteorological data (without deposition) to determine concentrations of NO_x and SO_2 at the local ecologically sensitive sites.

ADMS model runs were also performed using the ADMS dry deposition module using the deposition velocities shown in Table 3.1.9. As deposition velocities to tree canopies are generally higher than to low-lying vegetation, one set of five year runs was performed for each of the two vegetation categories. Wet deposition of both SO_2 and NO_x is negligible in comparison with dry deposition and was therefore omitted.

The deposition methodology is consistent with that developed through the Habitats Directive Working Group, comprising of members of the power generator's Joint Environmental Programme, the Environment Agency and the UK Conservation Agencies (Griffiths et al, 2006).

Table 3.1.9: Deposition parameter values used in ADMS

Substance	Dry deposition velocity for low-lying vegetation, v_d (m/s)	Dry deposition velocity for woodland, v_d (m/s)
Nitrogen Dioxide	0.0015	0.003
Sulphur Dioxide	0.012	0.024

3.1.9.3 Air Concentration Impacts on Vegetation and Eco-systems

As described in Section 3.1.2, the Air Quality Strategy Objectives for the protection of vegetation and ecosystems are not intended to apply at all locations. For example they are not intended to apply within 5km of either the proposed new units or the existing plant. The objectives are used in Section 3.1.9.4 and 3.1.9.5 to assess impacts at designated conservation sites within 15km of the new units. However to provide additional confidence that that the new units will not have a significant impact on any nearby vegetation and ecosystems, including locations not designated as nature conservation sites, predicted concentrations at the point of maximum impact for the new units are also compared to the objectives.

Predicted ground level concentrations of NO_x at the point of maximum impact equal 1.3µg/m^3. This is well within the objective of 30µg/m^3. This is based on the worst year of meteorology, i.e. the year which produces the maximum predicted concentration. Background concentrations at the maximum impact location have been obtained from the Air Pollution Information System, APIS (www.apis.ac.uk). APIS is a support tool for staff in the UK conservation and regulatory agencies, industry and local authorities for assessing the potential effects of air pollutants on habitats and species. The background NO_x as NO_2 concentration at the point of maximum impact is 27.6µg/m^3, and hence does not exceed the objective value of 30µg/m^3 in combination with the impacts from the proposed station. The contribution from the plant comprises 4.3% of the objective value. Predicted concentrations at distances of more than 5km from the plant, i.e. outside the area where the objectives do not strictly apply, are less than 0.81 µg/m^3 and hence comprise less than 3% of the objective at most even for this high emissions scenario.

Given the pessimistic nature of the emissions scenario, the low level of impact and the compliance with the air quality objective, it can be assumed that NO_x emissions from the proposed new units are unlikely to have significant impact on local vegetation and ecosystems

Predicted annual mean sulphur dioxide concentrations resulting from the new units at the point of maximum impact equal 1.3µg/m^3. Background concentrations taken from APIS equal 8.5µg/m^3. The contribution from the new units on its own and in combination with existing background concentrations therefore complies with the air quality standard for the protection of vegetation and ecosystems of 20µg/m^3.

3.1.9.4 Air Concentrations at Designated Sites

As described in Section 3.1.9.1, there are three SACs, four SPAs, four RAMSAR sites and nineteen SSSIs located within 15km of the proposed new units. Specific critical levels for air concentrations based upon the default critical levels of annual averages of 20µg/m^3 for SO_2 and 30µg/m^3 for NO_x, taken from the UK Air Quality Strategy Objectives for the Protection of Vegetation and Ecosystems have been supplied by English Nature (Chapman., 2005). The SSSI citations do not suggest the presence of lichen species, which would show greater sensitivity to SO_2, at any of the local sites.

The highest modelled concentrations over each of the sites considered and over the five meteorological years modelled were used to ensure a suitably precautionary approach. Similarly, the exclusion of deposition processes for the air concentration ADMS runs, which would in practice lower concentrations by removing material from the plume, further ensures a precautionary approach.

Table 3.1.10 presents the maximum modelled SO_2 concentrations at each local site together with the background concentration taken from the APIS database. It can be seen that whilst concentrations of SO_2 due to emissions from the proposed new units do reach the 1% significance threshold at a number of sites, the combination of process and background does not exceed the SO_2 critical level at any site and the process contribution alone is well below the critical level at all sites.

Table 3.1.11 presents the maximum modelled NO_x concentrations at each local site together with the background concentration taken from the APIS database. It can be seen that there are no Natura 2000 or Ramsar sites where concentrations of NO_x due to emissions from the proposed new units reach the 1% significance threshold and the combined impact of the proposed new units and background concentration exceed the critical level.

There are only two SSSI sites where concentrations of NO_x due to the proposed plant reach the 1% significance threshold and the combined impact exceeds the critical level, namely Chattenden Woods SSSI and Tower Hill to Cockham Wood SSSI. It can be seen from Table 3.1.11 that the impacts from the proposed station are very low, comprising only 1.2% and 1.5% of the NO_x critical level at Chattenden Woods SSSI and Tower Hill to Cockham Wood SSSI respectively, and that the background NO_x concentration alone exceeds the $30\mu gm^{-3}$ NO_x critical level at both of these sites. It is therefore evident that the exceedance derives from sources other than the proposed new units.

Given the precautionary nature of the assessment, taking the maximum concentration across five years at any point on the site and the assumption of full load operation throughout the year, it can be concluded with confidence that SO_2 and NO_x emissions from the proposed new units would not be at levels likely to lead to adverse effects on the sensitive ecological features at the local Natura 2000 sites or SSSIs.

Table 3.1.10: Sulphur dioxide concentrations due to emissions from the new units at local ecologically sensitive sites assessed against the 20µg/m^3 SO_2 critical level

Site	PC (µg/m^3)	PC/EAL	Background (µg/m^3)	PEC (µg/m^3)	PEC/EAL
Natura 2000/Ramsars					
Benfleet & Southend Marshes Ramsar and SPA	Designated features not sensitive				
Thames Estuary & Marshes Ramsar and SPA	0.86	4.3%	8.8	9.7	48%
Medway Estuary & Marshes Ramsar and SPA	1.29	6.5%	8.0	9.3	46%
The Swale Ramsar amd SPA	0.31	1.6%	7.9	8.2	41%
Queendown Warren SAC	0.27	1.3%	7.8	8.1	40%
North Downs Woodlands SAC	0.19	0.9%	9.0	9.2	46%
Peter's Pit SAC	Designated features not sensitive				
SSSIs					
The Swale SSSI	0.31	1.6%	7.9	8.2	41%
Chattenden Woods SSSI	0.36	1.8%	8.5	8.9	44%

Site	PC ($\mu g/m^3$)	PC/EAL	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/EAL
South Thames Estuary & Marshes SSSI	0.86	4.3%	8.8	9.7	48%
Great Crabbles Wood SSSI	0.27	1.3%	8.5	8.8	44%
Queendown Warren SSSI	0.27	1.3%	7.8	8.1	40%
Medway Estuary & Marshes SSSI	1.29	6.5%	8	9.3	46%
Shorne & Ashenbank Woods SSSI	0.25	1.2%	9.2	9.4	47%
Peters Pit SSSI	0.16	0.8%	7.6	7.8	39%
Northward Hill SSSI	0.48	2.4%	7.9	8.4	42%
Halling to Trottiscliffe Escarpment SSSI	0.21	1.04%	10	10.2	51%
Purple Hill SSSI	0.24	1.2%	7.8	8.0	40%
Wouldham to Detling Escarpment SSSI	0.20	0.99%	9	9.2	46%
Tower Hill to Cockham Wood SSSI	0.44	2.2%	8.3	8.7	44%
Cobham Woods SSSI	0.26	1.3%	7.6	7.9	39%
Holborough to Burham Marshes SSSI	0.17	0.8%	7.6	7.8	39%
Holehaven Creek SSSI	0.24	1.2%	9.5	9.7	49%
Mucking Flats & Marshes SSSI	0.35	1.8%	8.5	8.9	44%
Vange & Fobbing Marshes SSSI	0.26	1.3%	8.5	8.8	44%
Benfleet & Southend Marshes SSSI	0.40	2.0%	8.9	9.3	47%

Table 3.1.11: Nitrogen Oxides concentrations due to emissions from the new units at local ecologically sensitive sites assessed against the 30µg/m^3 NO_x critical level

Site	PC ($\mu g/m^3$)	PC/EAL	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/EAL
Natura 2000/Ramsars					
Benfleet & Southend Marshes Ramsar and SPA	Designated features not sensitive				
Thames Estuary & Marshes Ramsar and SPA	0.87	2.9%	25.9	26.8	89%
Medway Estuary & Marshes Ramsar and SPA	1.29	4.3%	23.0	24.3	81%
The Swale Ramsar amd SPA	0.31	1.04%	21.3	21.6	72%
Queendown Warren SAC	0.27	0.9%	31.3	31.6	105%
North Downs Woodlands SAC	0.19	0.6%	39.5	39.7	132%
Peter's Pit SAC	Designated features not sensitive				
SSSIs					
The Swale SSSI	0.31	1.04%	21.3	21.6	72%
Chattenden Woods SSSI	0.36	1.2%	32.4	32.8	109%
South Thames Estuary & Marshes SSSI	0.87	2.9%	25.9	26.8	89%
Great Crabbles Wood SSSI	0.27	0.9%	32.4	32.7	109%
Queendown Warren SSSI	0.27	0.9%	31.3	31.6	105%
Medway Estuary & Marshes SSSI	1.29	4.3%	23.0	24.3	81%
Shorne & Ashenbank Woods SSSI	0.25	0.8%	33.7	33.9	113%
Peters Pit SSSI	0.16	0.5%	34.3	34.5	115%
Northward Hill SSSI	0.48	1.6%	27.3	27.8	93%
Halling to Trottiscliffe Escarpment SSSI	0.21	0.7%	36.1	36.3	121%

Site	PC ($\mu g/m^3$)	PC/EAL	Background ($\mu g/m^3$)	PEC ($\mu g/m^3$)	PEC/EAL
Purple Hill SSSI	0.24	0.8%	31.3	31.5	105%
Wouldham to Detling Escarpment SSSI	0.20	0.7%	34.8	35.0	117%
Tower Hill to Cockham Wood SSSI	0.44	1.5%	33.8	34.2	114%
Cobham Woods SSSI	0.26	0.9%	34.3	34.6	115%
Holborough to Burham Marshes SSSI	0.17	0.6%	34.3	34.5	115%
Holehaven Creek SSSI	0.24	0.8%	27.6	27.8	93%
Mucking Flats & Marshes SSSI	0.35	1.2%	28.3	28.7	96%
Vange & Fobbing Marshes SSSI	0.26	0.9%	28.3	28.6	95%
Benfleet & Southend Marshes SSSI	0.40	1.3%	19.8	20.2	67%

3.1.9.5 Deposition from Air to Land at Designated sites

Emissions can also have an impact on sensitive ecological sites via deposition of acidity or nutrient nitrogen from air to land. The Environment Agency, in conjunction with the UK Conservation Agencies has provided acid and nutrient nitrogen critical loads for all designated features at UK SAC and SPA Habitats Sites (Environment Agency, 2005a, b and c) and for selected SSSIs local to the existing Kingsnorth station (Whitfield., 2005).

The SAC and SPA critical loads are set to protect all designated Habitats species present and the ecosystems which support them. For the SSSIs, acid and nutrient nitrogen critical loads provided by the Environment Agency have been used where available, and otherwise extracted from the APIS database for the appropriate designated features. This methodology follows that adopted for the existing Kingsnorth power station PPC application (Brooke et al., 2006), as agreed with the Environment Agency and English Nature.

The highest deposition over each sensitive site for the five years modelled was assessed against the most stringent critical load impact for all features present in order to ensure a precautionary approach. Where both woodland and non-woodland sensitive features were present, the results for the feature with the highest deposition to critical load ratio were assessed to take account of the differing deposition velocities and identify the worst-case impact.

3.1.9.5.1 Nutrient Nitrogen Deposition Assessment

Table 3.1.12 presents the nutrient nitrogen critical load assessment for the local Natura 2000 and SSSI sites. It can be seen that the nutrient nitrogen deposition arising from the proposed new units is well below the assigned critical loads for all of the local sensitive ecological sites and only reaches the 1% significance threshold at one Natura 2000 site (Medway Estuary and Marshes Ramsar) and six of the local SSSIs. The process contribution is below 2% of the assigned critical load at all of these sites and contributes 1.1% or less of the total nitrogen deposition, whereas the background contribution alone ranges from 174% to 344% of the critical load. It is evident that sources other than the proposed new units dominate nitrogen deposition impacts at all local ecological sites and that the contribution from the proposed new units would make a negligible difference to the impacts of deposited nitrogen.

Given the extremely low levels of impact and the worst case nature of the assessment, it can reasonably be assumed that nitrogen deposition resulting from emissions from the proposed new units will not lead to significant adverse effects at

local Natura 2000 sites or be at levels likely to damage the special interest features at the local SSSIs.

Table 3.1.12: Nutrient nitrogen deposition due to emissions from the new units at local ecologically sensitive sites assessed against NutN critical load

Site	C_{load}	PC kgN/ha/yr	PC/EAL	Back ground kgN/ha/yr	PEC kgN/ha/yr	PEC/ EAL
Natura 2000/Ramsars						
Benfleet & Southend Marshes Ramsar and SPA	30	0.06	0.2%	15.3	15.36	51%
Thames Estuary & Marshes Ramsar and SPA	30	0.12	0.4%	16.7	16.82	56%
Medway Estuary & Marshes Ramsar and SPA	10	0.19	**1.9%**	17.4	17.6	176%
The Swale Ramsar amd SPA	15	0.04	0.3%	17.8	17.84	119%
Queendown Warren SAC	15	0.04	0.3%	21.4	21.43	133%
North Downs Woodlands SAC	10	0.05	0.5%	40.5	40.55	405%
Peter's Pit SAC	Designated features not sensitive					
SSSIs						
The Swale SSSI	15	0.04	0.3%	17.8	17.84	119%
Chattenden Woods SSSI	10	0.10	**1.0%**	34.4	34.5	345%
South Thames Estuary & Marshes SSSI	10	0.12	**1.2%**	16.7	16.8	168%
Great Crabbles Wood SSSI	10	0.07	0.7%	33.9	34.0	340%
Queendown Warren SSSI	10	0.07	0.7%	36.7	36.8	368%
Medway Estuary & Marshes SSSI	10	0.19	**1.9%**	17.4	17.6	176%
Shorne & Ashenbank Woods SSSI	10	0.07	0.7%	36.1	36.2	362%
Peters Pit SSSI	10	0.02	0.2%	20.2	20.2	202%
Northward Hill SSSI	10	0.16	**1.6%**	32.8	33.0	330%
Halling to Trottiscliffe Escarpment SSSI	10	0.06	0.6%	38.2	38.3	383%
Purple Hill SSSI	10	0.07	0.7%	36.7	36.8	368%
Wouldham to Detling Escarpment SSSI	10	0.06	0.6%	40.5	40.6	406%
Tower Hill to Cockham Wood SSSI	10	0.13	**1.3%**	34.4	34.5	345%
Cobham Woods SSSI	10	0.07	0.7%	38.2	38.3	383%
Holborough to Burham Marshes SSSI	10	0.02	0.2%	20.2	20.2	202%
Holehaven Creek SSSI	Features not sensitive					
Mucking Flats & Marshes SSSI	Features not sensitive					
Vange & Fobbing Marshes SSSI	10	0.05	0.5%	18.6	18.7	186%
Benfleet & Southend Marshes SSSI	10	0.11	**1.1%**	25.9	26.0	260%

3.1.9.5.2 Acid Deposition Assessment

Table 3.1.13 presents the assessment for the Natura 2000 sites using critical loads extracted from the Environment Agency databases, presented as maximum acid sulphur and acid nitrogen deposition, expressed as kilo-equivalents (of H^+) per hectare per year. Table 3.1.14 presents the acid deposition assessment for the stand-alone SSSIs using critical loads supplied by the Environment Agency or from the APIS database. Where the information provided by the Environment Agency indicates that the critical loads for the corresponding Natura 2000 sites are sufficient to protect the SSSI features, the Natura 2000 site assessment has been applied. Note that APIS presents critical loads as total acidity and the modelled deposited acidity is the sum of the nitrogen and sulphur components as keq/ha/yr.

Again, the worst case deposition over five years and the highest deposition over any point on each site have been used.

It can be seen from Tables 3.1.13 that acid nitrogen deposition arising from the proposed new units is well below the assigned critical loads for all of the local Natura 2000 sites and does not reach the 1% significance threshold for any.

Table 3.1.14 presents the acid critical load assessment for the local SSSIs. It can be seen that that acid deposition arising from the proposed new units alone is well below the assigned critical loads for all of the local sensitive ecological sites. Deposition due to the emissions from the new units reaches the 1% significance threshold at eight sites where the critical load is exceeded by the total deposition. The process contribution is, however, below 3% of the assigned critical load at seven of these sites and contributes a maximum of 5.4% at the Tower Hill to Cockham Woods SSSI. The background contribution ranges from 124% to 560% of the critical load, with the proposed new units contributing less than 2.2% of the total acid deposition across these sites. At the Tower Hill to Cockham Woods SSSI, the new units contribute only 1.6% of the total acid deposition, against a background of contribution of 327% of the critical load. It is evident that sources other than the proposed new units dominate acid deposition impacts at all local ecological sites and the contribution from the proposed new units would make a negligible difference to the total deposited acidity.

The above assessment can be considered an extremely pessimistic scenario for the following reasons:

- The highest deposition across the whole of each site was assessed.
- The highest deposition across five years of meteorological data was assessed.
- The lowest assigned critical loads have been used.
- It has been assumed that all nitrogen emissions are in the form of NO_2. Emissions of NO_x from combustion plant are primarily in the form of NO (>90%) which has a negligible dry deposition rate. Within ten kilometres of the new units, the maximum conversion from NO to NO_2 is likely to be 75% and will be less than this closer to the stack (Futter et al, 2002). The net effect will be to over-estimate the contribution to acid deposition from nitrogen.
- It has been assumed that the station operates on full load for the entire year, whereas in practice a load factor of around 80% would be more likely.

Given that even for the worst-case scenario modelling, the new units contributed less than 5.5% of the critical load and less than 2% of the deposition at the highest impact site, it is reasonable to assume that acid deposition arising due to emissions from the proposed new units would not be at levels likely cause a significant adverse effect on

features at the local Habitats site or likely to damage the special interest features at local SSSIs.

Table 3.1.14: Acid deposition due to emissions from the proposed station at local SSSIs assessed against acid critical load

Site	C_{load}	PC (keq/ ha/yr)	PC/EAL	Back ground (keq/ha /yr)	PEC (keq/ha /yr)	PEC/ EAL
The Swale SSSI	Assessed as for The Swale SPA					
Chattenden Woods SSSI	0.35	0.008	**2.3%**	1.99	2.01	571%
South Thames Estuary & Marshes SSSI	Assessed as for Thames Estuary & Marshes SPA					
Great Crabbles Wood SSSI	1.0	0.027	**2.7%**	3.12	3.15	315%
Queendown Warren SSSI	Assessed as for Queendown Warren SPA					
Medway Estuary & Marshes SSSI	Assessed as for Medway Estuary & Marshes SPA					
Shorne & Ashenbank Woods SSSI	0.98	0.025	**2.5%**	3.32	3.34	341%
Peters Pit SSSI	4.0	0.003	0.1%	2.03	2.03	51%
Northward Hill SSSI	2.4	0.066	**2.8%**	2.98	3.05	127%
Halling to Trottiscliffe Escarpment SSSI	4.0	0.043	**1.1%**	2.28	2.32	58%
Purple Hill SSSI	1.7	0.024	**1.4%**	3.28	3.30	194%
Wouldham to Detling Escarpment SSSI	Assessed as for North Downs Woodlands SAC					
Tower Hill to Cockham Wood SSSI	0.96	0.052	**5.4%**	3.14	3.19	332%
Cobham Woods SSSI	1.06	0.027	**2.5%**	3.58	3.60	337%
Holborough to Burham Marshes SSSI	1.5	0.003	0.2%	2.03	2.03	136%
Holehaven Creek SSSI	Features not sensitive					
Mucking Flats & Marshes SSSI	Features not sensitive					
Vange & Fobbing Marshes SSSI	4.0	0.053	**1.3%**	1.94	1.99	50%
Benfleet & Southend Marshes SSSI	2.36	0.048	**2.0%**	3.14	3.19	135%

3.1.9.6 Conclusions

Assessments for air concentrations, nutrient nitrogen deposition and acid deposition have been performed for all ecologically sensitive sites within 15km of the proposed new units. The highly precautionary nature of the assessment process and the very low levels of impact confirm that neither air concentrations nor deposition arising as a result of emissions from the new units are at levels likely to cause a significant adverse effect at the local Natura 2000 sites or likely to damage the special interest features at the local SSSIs.

Table 3.1.13. Acid deposition due to emissions from the proposed new units at local Natura 2000 sites assessed against acidity critical loads

Site	MaxS C_{load} keq/ha/yr	S deposition keq/ha/yr	% MaxS	MaxN C_{load} keq/ha/yr	N deposition keq/ha/yr	% MaxN	C_{load} Source
Benfleet & Southend Marshes Ramsar and SPA	Designated features not sensitive						EA
Thames Estuary & Marshes Ramsar and SPA	Designated features not sensitive						EA
Medway Estuary & Marshes Ramsar and SPA	Designated features not sensitive						EA
The Swale Ramsar amd SPA	Designated features not sensitive						EA
Queendown Warren SAC	3.93	0.003	0.1%	4.79	0.0027	0.1%	EA
North Downs Woodlands SAC	1.94	0.018	0.9%	2.08	0.0035	0.2%	EA
Peter's Pit SAC	Designated features not sensitive						EA

References

Brooke D., Griffiths S., Sadler K., Lennard R (2006) Impact of atmospheric emissions from JEP coal- and oil- fired power stations on sites protected by the Habitats Directive. JEP Report for PPC applications ENV/054/2005, PT/06/BE130/R.

Chapman C (2005) Excel spreadsheet 'SAC Ramsar Critical Levels EN advice.xls' Supplied by email 21/06/05. Caroline Chapman, English Nature.

DETR and the devolved administrations, (2000). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, Cm4548, SE2000/3, NIA7.

Environment Agency, (2005a). Excel spreadsheet 'SAC_species_UK_CL.xls'. Provided by Colin Powlesland 12/07/2005.

Environment Agency, (2005b). Excel spreadsheet 'SAC _UK_CL.xls'. Provided by Colin Powlesland 12/07/2005.

Environment Agency, (2005c). Excel spreadsheet 'SPA _UK_CL.xls'. Provided by Colin Powlesland 24/06/2005.

Futter D N, Curran D, Acres D, Hunter GC &, Webb AH, (2002). Estimated annual mean NO_2 concentrations due to NO_x emissions from large fossil-fuelled power stations. JEP Report PT/01/BE866/R

Griffiths S J, Sadler K, Brooke D, Rodgers I & Acres D, (2006). Methodology for Assessing the Impact of Power Stations on Habitats Directive Sites in the UK. JEP report PT/05/BE1029/R.

Whitfield C (2005) Excel Spreadhseet 'SSSI_screening_England_17Oct05.xls' Supplied by email 17/10/05. Claire Whitfield, JNCC.

3.2 Water Quality

3.2.1 Introduction

The most significant aquatic impact from the operation of the new units will arise from the cooling water (CW) system. The new units will use a direct water cooled system, based on that used by the existing power station at Kingsnorth, utilising the existing intake and outfall. Water will be abstracted from the Medway, during its passage through the condensers its temperature is increased, then the volume of water abstracted will be returned to the Medway at a temperature above the ambient water temperature. Direct water cooling is the most efficient form of cooling thereby minimising the global warming potential of the new units. Direct water cooling results in fewer emissions of carbon dioxide per unit of electricity generated than both air cooled systems and recirculating wet cooling systems utilising cooling towers;.

There will be a discharge of wastewater from the FGD plant, mainly to control chloride levels in the gypsum product to ensure that it meets criteria for a saleable product. Additionally the efficiency of the FGD process decreases as contaminants build up in the system; therefore a continuous purge is required to maintain a high efficiency. The purge, along with other wastewater from the FGD system is passed through a wastewater treatment plant (WWTP) before joining the station's CW discharge. The WWTP effluent contains chloride and trace metals, which will be discharged to the Medway Estuary in the CW discharge.

This section aims to identify and assess potential significant effects of the aqueous discharge from the new units during their construction and operation.

3.2.2 Environmental Assessment Levels for Medway Estuary

IPPC Horizontal Guidance Note H1 (Environment Agency, 2003) lists Environmental Quality Standards (EQS) and Environmental Assessment Levels (EAL) for various species. EQSs are statutory values, whereas EALs have no statutory basis, although they do represent a benchmark for harm against which any exceedence may be viewed as unacceptable. The EQSs and EALs are shown in Table 3.2.1. A mixing zone is allowed for around outfalls, within which water quality standards will not be met.

There are currently no statutory temperature standards for estuaries, although the Environment Agency has recently produced guidance on assessing thermal discharges in relation to designated sites (WQTAG160). This is relevant to Kingsnorth as the nearby Medway Estuary saltmarshes and mud flats are designated as a Special Protection Area (SPA) under the Wild Birds Directive (92/43/EEC).

WQTAG160 sets out the Environment Agency's current position that can be used in determining Habitats Directive assessments. Thermal impacts are assessed against two criteria:

- The deviation above the ambient temperature of the receiving water
- The exceedences of a maximum temperature threshold

Temperature thresholds are based on the designation of the site and are listed in Table 3.2.2. The Medway Estuary and Marshes are designated as an SPA, therefore the maximum allowable excess temperature at the edge of the mixing zone is +2°C

and the maximum temperature at the edge of the mixing zone is 28°C as a 98th percentile. Salmonids are not believed to be present in the Medway Estuary.

WQTAG160 states that the ambient temperature should exclude any increase in background temperature associated with the long term build up of heat. This is partly why the Warp Anchorage temperature data has been used to estimate ambient temperatures, as discussed in Section 3.2.3.

WQTAG160 states that the extent of the mixing zone should be calculated using the approach set out in WQTAG083f (Babbedge & Taylor 2005). This includes estimating the extent of the mixing zone in the form of a maximum allowable concentration from the instantaneous mixing zone at the four stages of the tide: high water (HW), mid-ebb, low water (LW), mid-flood. Plots of temperature contours have been produced at these stages of the tide for all scenarios modelled for this study. WQTAG083f acknowledges that estimation of the extent of the annual average mixing zone is complex and rigorous assessment is usually unnecessary.

The guidance states that a mixing zone is acceptable if it can be demonstrated that it has no effect on site integrity. There is no clear definition of exactly what affects site integrity, leaving WQTAG160 open to interpretation, although it does provide some guidelines:

- The mixing zone should not form a barrier to migration across the whole estuary or block areas of the estuary through which fish are likely to pass
- In tidal waters, the discharge should not prolong the duration of the maximum natural temperature to the extent that would begin to have a negative impact on biota (intertidal surfaces can reach temperatures >30°C when exposed to summer sun, compared with water temperatures >20°C in late summer)
- The impact of the mixing zone should be assessed during worst case conditions (e.g. low river flow and neap tide, when dilution of the plume is lowest)
- Additive spatial and temporal effects should be considered where more than one discharge impacts on the site.

3.2.3 Existing Environmental Conditions

Kingsnorth power station is adjacent to the Medway Estuary. The lower reach of the Medway, downstream from Maidstone, is classed as an estuary. Section 3.1.9.1 provides information on sites of conservation interest in the vicinity of Kingsnorth, including seven Natura 2000 sites within 15 km of Kingsnorth.

A map of the Medway Estuary, including the Kingsnorth CW intake and outfall is shown in Figure 3.2.1. The Kingsnorth CW outfall discharges into Damhead Creek, which forms the outfall channel. Damhead Creek becomes East Hoo Creek. Stoke Saltings (mudflats of ecological interest) are to the immediate north east of East Hoo Creek. East Hoo Creek flows into Kethole Reach, the main channel of the Medway Estuary. The creeks and reaches are shown in Figure 3.2.1.

The Medway Estuary is a tidal saline water habitat, subject to diurnal fluctuations in water level. The tidal range at Bee Ness Jetty is 5.4m on a spring tide and 3.3m on a neap tide. Further tidal levels are reported in Table 3.2.3. On the ebb tide, the

receiving water affected by the CW discharge moves downstream along Kethole Reach and Saltpan Reach, towards the confluence with the Thames estuary, which finally enters the North Sea. Water drains from the tidal flats during the ebb tide. On the returning flood tide, estuarine water travels upstream along Saltpan Reach, Kethole Reach, and beyond Oakham Ness Jetty along Long Reach. During the flood tide Stoke Saltings become submerged to varying extents depending on the tide.

The tidal flats consist of a silt substrate, which has been identified as river terrace deposits by the British Geological Survey. The estuary is accustomed to withstanding swift changes on each tide, including natural heating of tidal flats resulting from incoming solar radiation and reductions in temperature when cooler coastal water enters the estuary on each flood tide.

In addition to the existing Kingsnorth power station, there are two other operational power stations and a proposed power station that abstract and discharge cooling water to the Medway:

- Grain power station, also owned by E.ON UK, is a 2 x 660 MW direct cooled oil-fired power station, which abstracts downstream of Saltpan Reach and discharges close to the mouth of the Medway. The oil-fired station operates with a low annual load factor.
- Medway Power is a 700 MW gas-fired combined cycle gas turbine (CCGT) power station owned and operated by Scottish and Southern Energy plc, utilising hybrid cooling towers. Make-up water is abstracted from Saltpan Reach, whilst purge water is discharged slightly further downstream into Saltpan Reach.

- Proposed 1200 MW gas-fired direct cooled CCGT for which E.ON UK has recently received consent under Section 36 of the Electricity Act 1989

The warm cooling water discharged from the existing Kingsnorth and Grain power stations was instrumental in establishing designated bass nurseries in the discharge channels from both power stations.

There is evidence (Bamber & Spencer, 1984) that at Kingsnorth, the impacts on benthic fauna are limited to some changes in species composition, rather than in the abundance. The study was undertaken 20 years ago, when Kingsnorth operated with a much higher load factor than it does today and therefore when its impact would have been greater than it currently is. The species most conspicuously eliminated from Damhead Creek were those with calcareous shells. Abundance of benthic invertebrates tended to be higher in the most thermally impacted areas. There is no evidence to suggest that food sources for wading birdlife, which are the features of conservation interest for the Medway Estuary and Thames Estuary sites, are threatened by the CW discharge from the existing Kingsnorth power station.

The most representative temperature data for the Medway, into which Kingsnorth discharges, was obtained from SmartBuoy data at Warp Anchorage (CEFAS, 2004). Warp anchorage is located at 51°31.5'N, 1°1.9'E, which lies within the modelled area. Statistics of the water temperature at Warp recorded daily from 7 Jan 2001 to 6 Jan 2004 are shown in Tables 3.2.4 and 3.2.5. Table 3.2.5 also shows CW inlet temperatures at Kingsnorth, based on average monthly readings from 2004. As expected the data shows that temperatures at Kingsnorth are greater than at Warp.

Further temperature data in the Medway was obtained from the Environment Agency. This is summarised in Table 3.2.6, along with data from Warp Anchorage and the Kingsnorth CW inlet. Monthly temperatures are available from:

- Bartlett Creek (OS grid reference TQ8350069700) from Autumn 1991 to Autumn 2004
- Elphinstone at Low Water (OS grid reference TQ8600073500) from Autumn 1991 to Autumn 2004
- Darnett Ness at High Water (OS grid reference TQ8030070800) from Autumn 1980 to Autumn 2004
- Darnett Ness at Low Water (OS grid reference TQ8030070800) from Autumn 1980 to Autumn 2004
- North Kent Buoy at Low Water (OS grid reference TQ8950074000) from Autumn 1994 to Autumn 2004
- Oakham Ness at Low Water (OS grid reference TQ8420071700) from Autumn 1980 to Autumn 2004.

All temperature monitoring reported in Table 3.2.6 shows that the maximum temperature is below 28°C. The maximum temperature at Oakham Ness, close to the point where Damhead Creek (the CW discharge channel) joins Kethole Reach (the deep channel of the Medway) is only 24.1°C. This is influenced by the operation of the existing power station at Kingsnorth. The maximum temperature of 27.3°C at the North Kent Buoy could possibly result from the CW discharge from Grain power station. It is slightly surprising that the North Kent Buoy maximum recorded temperature is greater than that at Oakham Ness, given the locations of the Kingsnorth and Grain CW discharges relative to the monitoring sites, although the existing Grain CW discharge is at a higher temperature.

Background water temperatures were specifically taken from Warp Anchorage because:

- daily data over several years is available from Warp anchorage, allowing annual statistics to be calculated
- the data in the Medway itself is affected by the Kingsnorth power station discharge, which operates on most days, although not continuously. Note that Kingsnorth power station would affect temperatures in the Medway for several weeks after the station last generated, as the rate of exchange of Medway water with Thames water is relatively low in the vicinity of Kingsnorth
- it is not desirable to include the effect of Kingsnorth power station in background temperatures included in the analysis, as this would lead to double accounting.

The existing power station at Kingsnorth monitors the water quality of the current CW outlet, which can be considered equivalent to the current ambient water quality in the Medway Estuary as the quality of CW at the existing station is largely unchanged by its passage through the power station with respect to trace species. Table 3.2.7 gives statistics on trace metal concentrations derived from monthly data from July

2003 to June 2006. For all trace elements the median ambient concentration is below the annual average EQS/EAL value.

Water in the Medway Estuary is similar to that of seawater. Sulphate and chloride concentrations have not been monitored recently, but historical data is given in Table 3.2.8.

3.2.4 Impact Assessment

The H1 methodology has been used to assess the FGD WWTP discharge. Two scenarios have been covered:

- operation at full load at the expected consent limits, which represents a worst case.
- operation at full load with the design coal for the FGD plant, which represents a less extreme case, but still with higher than likely average WWTP effluent concentrations

Three dimensional time-dependent (i.e. tidal) modelling of the advection and dispersion of the warm CW discharge has been undertaken using the DELFT3D software, licensed from the Dutch company WL Delft Hydraulics. DELFT3D is a sophisticated hydrodynamic and water quality modelling package. A site specific model of the Medway and its confluence with the Thames Estuary was developed three years ago and was also used in the Environmental Statement for the proposed CCGT at Grain (E.ON UK, 2005). The CW assessment covers the operation of the new units alone and also simultaneous operation with Medway Power and the proposed CCGT at Grain operating.

3.2.4.1 Intake

The current surface water abstraction licence allows for an annual abstraction to cover once-through cooling, ash handling and processing and should be sufficient to cover the cooling water requirements of the new units . The site also has a licence to abstract water from boreholes. Process water for operation of the FGD plant will be provided by a desalination plant, supplied with estuary water. It has not been decided if the estuary water for the desalination plant will be diverted from the CW system, or be provided via a new abstraction point. The FGD process water quantities required are small in relation to the CW requirements. The existing abstraction licences will cover the quantities required, although the abstraction licence will need to reflect the minor change in use.

The CW intake structure is on the shoreline, immediately to the south of the existing power station. A dredged channel of approximately 130 m offshore leads from the deep channel of the Medway Estuary to the intake structure. Water is drawn in over the depth of the water column at the intake structure.

The possibilities of fish entrainment are discussed in Section 3.5.7.

3.2.4.2 Discharge

The CW discharges via concrete outlet culverts to a shoreline outfall structure built into the head of Damhead Creek. A minimum level is maintained by a weir. At low water (LW) the discharged CW flows along Damhead Creek, into East Hoo Creek, from which it is discharged into the main channel of the Medway. At high water (HW)

East Hoo Creek is submerged and the flow direction of CW exiting Damhead Creek is not restricted by the banks of East Hoo Creek.

The existing station is authorised to discharge 5.6 M m^3/day via the CW outlet to Damhead Creek, equating to a continuous flow of 64.8 m^3/s. The proposed new units are expected to discharge within the limit for the existing station. The existing station has four CW pumps, which are assumed to have a capacity of 15.48 m^3/s each. For the purposes of this assessment it has been assumed that the maximum CW flow rate for the proposed 2 x 800 MW new units will be the same as the maximum CW flow rate for the existing 4 x 485 MW station (4 x 15.48 m^3/s). In practice the flow rate for the proposed new units may differ. However the heat discharged, rather than the flow rate and associated temperature, has the most significant effect on the resulting temperature field in the estuary.

Typical flow rates from the FGD WWTP are expected to be in the range 1.2 l/s to 1.8 l/s, with a chloride concentration of 30,000 ppm, for both new units operating at full load. Trace elements derived from coal and limestone will be present in the FGD effluent. Trace elements precipitate out in the FGD WWTP as sludge. However small quantities remain in dissolved form. The removal efficiency of selenium and antimony is dependent on the oxidation state of the metals, which cannot be predicted. Neither selenium (VI) nor antimony (IV) will be removed by the WWTP. Additionally, boron and chloride are not removed by the WWTP. The dissolved trace species content of the WWTP effluent is related to the solubility product of the trace element in question. The FGD WWTP effluent will join the CW flow before final discharge to Damhead Creek.

There will be a waste stream from the desalination plant consisting of warm salty water. It is likely that this will join the CW flow before final discharge to the Medway Estuary via the CW outlet at Damhead Creek. Given that the receiving water is already saline, and volume of CW is high compared with the waste water discharge from the desalination plant, no adverse impacts on the estuary are expected to be associated with the desalination plant and it is not considered further.

3.2.4.3 H1 Assessment

3.2.4.3.1 H1 Methodology

In the H1 assessment methodology for water, the environmental impact for potential aqueous releases is assessed by comparing the process contribution with the relevant environmental benchmark. The environmental benchmarks are the EALs given in Table 3.2.1 (taken from H1). In some cases the EAL exists as a statutory EQS. The process contribution, PC_i, for a species discharged to a river is defined as:

$$PC_i = \frac{\text{effluent flow rate x release concentration}}{\text{effluent flow rate + river flow rate}}$$

This equation has been used to calculate the PC at the outfall, assuming no mixing with the estuary. The effluent refers to the WWTP and the river flow refers to the CW.

The environmental quotient for a species is defined as:

$$EQ_i = \frac{PC_i}{EAL_i}$$

The environmental quotient for water, EQ_{water}, is the sum of EQ_i over all species, although EQ_{water} is not used in this assessment. The absolute value of EQ_{water} has no meaning. Relative values of EQ_{water} can be useful for comparing different options/scenarios for an installation.

Release of a species is screened out as insignificant if EQ_i<1%, i.e. if the PC is less than 1% of the EAL. This holds for both short term and long term EALs.

Note that if the discharge of species cannot be screened out as insignificant, it does not necessarily follow that the species will have a significant effect on the environment.

For species that cannot be screened out as insignificant, the predicted environmental concentration, PEC, is estimated. The PEC is defined as the sum of PC and the background concentration.

$PEC_i = PC_i + background_i$

Detailed modelling of the discharge to the river is not required for species where

- PEC < 70% EAL
- PC < 20% EAL for species with a short term EAL

3.2.4.3.2 H1 Assessment for Worst Case

As a worst case, consent limits for an operational 2000 MW station have been assumed. In practice, operational stations discharge at concentrations below the consent conditions for the majority of the time. The maximum FGD WWTP that can be maintained for a sustained period will be of the order of 2 l/s. It is theoretically possible for the flow rate to exceed this for short periods (e.g. < 1 hour) under abnormal operating conditions. For assessment purposes, an FGD WWTP flow rate of 10 l/s has been chosen arbitrarily as a flow that is higher than will occur in practice and therefore represents a worst case.

It is assumed the FGD WWTP discharge mixes completely with the CW discharge, before release to the Medway. Other than for temperature, the CW itself is assumed to make a zero contribution to the PC (since any species within the CW were derived from the ambient estuary water, not from the process; the PEC accounts for ambient concentrations). The process contribution (PC) has been calculated at the outfall point, i.e. no dilution by the estuary water has been assumed. The predicted environmental concentration is also calculated at the outfall.

The results of the H1 assessment are shown in Tables 3.2.9, which gives:

- WWTP discharge concentration
- discharge concentration at the outlet to the Medway (WWTP mixed with CW)
- PC at outfall
- EAL
- PC/EAL as a percentage
- Whether or not the release of the species is significant
- background concentration in the river
- PEC
- PEC/EAL as a percentage
- EQ_i

With the exception of silver and excess temperature, the process contribution at the CW outfall is predicted to be less than 1% of the corresponding EAL for all species considered, rendering their impact on the receiving water as insignificant. Silver has a PC of 1.6% of the EAL at the outfall. Mixing with the estuary will reduce this to less than 1% close to the outfall channel, should silver be discharged at the expected consent limit. There is no ambient concentration data for silver available, but given the relatively small PC for this worst case, the impact of silver discharged can be assumed to be small without any detailed modelling. Detailed modelling of the excess temperature discharged is discussed in Section 3.2.4.4.

Monthly and annual mass release limits have been set for operational FGD plant in the UK, in addition to concentration limits. The monthly load permitted is less than the release that would occur for the maximum permitted WWTP flow and concentrations occurring continuously for a month, although the factor varies for different species. The annual mass release permitted tends to be about 45% of the corresponding monthly release scaled up to a year. Whilst concentration consent limits that are set for the new units are expected to be similar, if not identical to existing limits for operational 2000 MW FGD stations, mass release limits are expected to be smaller for Kingsnorth, approximately in proportion to the size of the new units. Therefore it seems reasonable to estimate that mass release limits for Kingsnorth will be 80% of mass release limits for a 2000 MW FGD station.

Table 3.2.10 shows the mass release and possible consent limits of species from the FGD WWTP plant for the following time periods

- Predicted mass release per day assuming 100% load
- Predicted mass release per month assuming 100% load
- Possible monthly mass release limit (80% of monthly limit for 2000 MW station)
- Predicted mass release per year assuming 100% load factor
- Predicted mass release per year assuming 80% load factor
- Possible annual mass release limit (80% of monthly limit for 2000 MW station)

The predicted monthly and annual mass releases, even at a load factor of 100% are, below the appropriately scaled mass release consent limits for an operational FGD station, for all species considered.

It should be noted that the predicted mass releases are expected to be a large over-estimate, since the concentrations in the FGD WWTP will not be sustained at the consent limit concentration all year and the WWTP effluent flow used is far higher than can be sustained in practice.

3.2.4.3.3 H1 Assessment for Design Case

Input for the design case, in which the design coal is burnt, has been obtained from a process model of the FGD plant, based on a maximum chloride concentration of 30,000 ppm in the FGD effluent. The WWTP plant flow rate for each unit is expected to be 0.6 l/s, giving a total of 1.2 l/s, while the species concentrations are shown in Table 3.2.11. As for the worst case, species concentrations are taken as the likely consent limits. In practice, species concentrations at operational FGD plant are considerably lower than the consent limits for the majority of the time, therefore typical concentrations are expected to be lower than modelled here

Table 3.2.11 also shows the results of the H1 assessment for the design case. For all species other than excess temperature, the PC is less than 1% of the EAL and

can be considered insignificant. Therefore under design operating conditions, the FGD WWTP effluent has no significant impact on the estuary. The effect of the heat discharged in the CW is assessed further in Section 3.2.4.4.

The predicted daily, monthly and annual mass releases are presented in Table 3.2.12, for a 100% load factor and also for a more realistic 80% load factor for the monthly and annual releases. The predicted mass releases in Table 3.2.12 can be expected to be a reasonable estimate of what will occur in practice. For all species considered, the estimated mass releases are all substantially below the appropriately scaled mass release consent limits for an operational FGD station.

3.2.4.4 Modelling of the Dispersion of the CW Discharge

DELFT3D was used to simulate the advection and dispersion of heat discharged via the CW. A subset of the model area in the vicinity of the power stations is shown in Figure 3.2.2. Bathymetry for the entire model area is shown in Figure 3.2.3a, with depths in the Medway Estuary shown in Figure 3.2.3b.

The model has 6 vertical layers and uses a timestep of 1 minute.

The freshwater water flow rate into the River Medway at the upstream boundary at Allington represents the lowest monthly average flow and is a conservative input to minimise dilution caused by the discharge of the River Medway into the estuary.

An ambient water temperature of 6°C has been used to be consistent with previous modelling studies of the Kingsnorth discharge. The model outputs the temperature, but excess temperature can be calculated easily by subtracting 6°C from the predicted temperature, allowing temperature prediction for all ambient conditions to be estimated. The predicted excess temperatures would be largely unaffected by the ambient water temperature, even if the model was run with a different ambient temperature. In practice, the meteorological conditions on a particular day, notably wind speed and direction, are likely to have a larger impact on excess temperature than the ambient temperature. Calm wind conditions (i.e. zero wind speed) have been assumed in all model runs. Higher wind speeds tend to cause more surface heat loss and therefore lower excess temperatures. Thus the scenarios modelled represent a worst case from the viewpoint of the cooling effect of wind on excess temperatures. Clearly, predicted currents will not contain a wind driven element as wind has not been included in the model.

Discharges have been simulated operating continuously for at least three weeks in the model, to allow build up of the far field excess temperature over many tidal cycles. Results were examined over a spring-neap cycle using tidal data from January 2003. The effect of recirculation on CW discharge conditions was not included, as this has only a secondary effect on excess temperatures throughout the estuary.

Two scenarios have been modelled:

i) the new units operating continuously at full load, with the discharge conditions shown in Table 3.2.13.

ii) the new units perating continuously at full load, proposed 1200 MW CCGT at Grain operating continuously at full load and 700 MW Medway Power CCGT

operating continuously at full load, with the discharge characteristics shown in Table 3.2.13.

Whilst all three stations will not operate continuously at full load, it is realistic to expect simultaneous operation of the new units and the CCGT at Grain close to full load for periods of time of the order of a month or more. Simulating the stations running continuously at full load represents a worst case.

Typical CW discharge conditions for the existing coal-fired station at Kingsnorth have been included in Table 3.2.13 for comparison only; no scenarios for the existing station have been included in this document. Note that should commissioning of one of the supercritical units be undertaken before all of the existing units have ceased to generate, the heat discharged would not be greater than that permitted by the current IPC authorisation for the existing Kingsnorth station and the impact of the discharged CW will be less than that for all four of the existing units operating at full load.

The new units operating at full load discharges only 54% of the heat discharged by the existing station operating at full. Whilst this partly results from the smaller size of the new units, the larger part of the reduction is caused by the greater efficiency of the new units. The CW flow rate for the new units at full load has been assumed to be the same as for the existing station at full load. In practice the new units may have a lower flow and higher excess temperature, but this does not change the heat discharged. The heat rather than the excess temperature, has the largest effect on the resulting excess temperature field throughout the estuary. The higher flow rate also represents a worst case from the viewpoint of fish entrainment.

All monitored temperatures reported in Table 4 are below 28°C. Given that the data recorded in the Medway spans more than 10 years and in some cases 20 years, during which period the existing Kingsnorth and Grain power stations will have operated with greater load factors than in the recent past (and with larger amounts of heat rejected to the estuary than the proposed generating options), it seems unlikely that temperatures at the monitoring locations within the Medway will exceed 28°C under future operating scenarios, in which the new units discharge heat to the CW at a lower rate than the existing station.

WQTAG160 allows a mixing zone with a maximum allowable temperature of 28°C as a 98th percentile. Taking the 98th percentile estuary temperature as 20.3°C (from Table 2), allows a corresponding excess temperature of 28.0-20.3 = +7.7°C. The area with an excess temperature of +7.7°C will obviously be smaller than the area with an excess temperature of +2°C. In fact the excess temperature of the CW discharge from the new units is <+7.7°C, predicting that the 28°C temperature threshold will not be reached, even in the discharge channel itself. For both scenarios considered, the WQTAG160 maximum temperature threshold of 28°C as a 98th percentile is less onerous than the excess temperature threshold of +2°C.

Results for both scenarios have been examined over the spring-neap cycle of 1-15 January 2003, then in more detail for the spring tide of 6th January 2003 and for the neap tide of 13 January 2003. These tides were chosen as representative of spring-neap cycles throughout the year.

3.2.4.4.1 Model Results for New Units Operating Alone

Predicted excess temperature statistics in the surface layer over a spring tide and a neap tide are shown in Table 3.2.14, whilst those for a spring-neap cycle are shown

in Figure 3.2.15. Table 3.2.14 shows that the CW discharge generally has a greater impact on excess temperatures during a neap tide than a spring tide. Excess temperatures in the bottom layer are generally less than, and certainly no more than, excess temperatures in the surface layer. The greatest difference between surface and bed temperatures tends to occur at the edge of the direct plume (i.e. where the temperature decreases rapidly with distance from the discharge point). For example at Bee Ness Jetty the maximum difference between the surface and bed temperatures is 4°C over the spring-neap cycle; the Bee Ness Jetty observational point is close to the end of the discharge channel and the edge of the direct plume is often in the vicinity. Conversely the observational point labelled TF7 within the tidal flats experiences the plume indirectly (i.e. the plume tends not to reach TF7 within one tide). Its temperature is indirectly affected by the discharge by virtue of water motion over several tidal cycles and is located where excess temperatures would be expected to be well mixed throughout the water column. This is reflected in the maximum difference between surface and bed temperatures of 0.7°C over the spring-neap cycle.

The results show that of the output locations considered other than in the discharge channel itself, the highest average excess temperature over a spring-neap cycle is +1.7°C, occurring at Bee Ness Jetty, with the highest 98th percentile excess temperature of +5.3°C also occurring at Bee Ness Jetty. The Bee Ness Jetty observational point is close to the end of the discharge channel and would be expected to pick up higher excess temperatures as CW has had minimal chance to mix with ambient estuary water at this location. Note the 98th percentile represents the statistic over a two week period of continuous operation. As the new units will probably have a load factor of about 80%, the expected annual statistics will be less than those predicted in the Table 3.2.15.

Surface temperature contour plots resulting from the new units with a CW flow rate of 61.92 m^3/s and an excess temperature of +6.7°C are shown at LW, HW-3, HW and HW+3 in Figures 7a, 7b, 7c and 7d respectively. The figures allow easy visualisation of the dispersion of the plume. The black areas represent mud flats that are dry at that stage of the tide. As expected there are more dry areas (i.e. exposed mud flats) in the LW plot (Figure 3.2.4a) than the HW plot (Figure 3.2.4c).

At LW (Figure 3.2.4a), the tide has just turned. The tail of the +1°C contour does not extend beyond the mouth of the Medway Estuary. The CW plume is ponding around the end of East Hoo Creek and Oakham Ness Jetty. Most of the Medway Estuary experiences excess temperatures of at least +1°C at some point during the neap tidal cycle.

At HW-3 hours there is less ponding around the end of East Hoo Creek. Part of the plume is advected westwards along Long Reach. Much of the western part of the Medway Estuary experiences excess temperatures of at least +1°C throughout the neap tidal cycle.

By HW the excess temperature along Kethole Reach has decreased to less than +1°C as a result of the influx of water from the Thames on the flood tide.

At HW+3 hours, at mid-ebb, the warm CW is advected eastwards towards the Thames. The Stoke Saltings tidal flats tend to experience greater exess temperatures at this stage of the tide as they are partially exposed and CW is advected towards and over them.

Much of the western part of the Medway Estuary experiences excess temperatures of more than +1°C, but less than +2°C throughout the neap tidal cycle.

The +2°C mixing zone (shown by the area within the boundary formed between the green and turquoise contours) at all four stages of the tide shown in the plots is relatively small compared with the area of the estuary and clearly does not extend across the width of the estuary. The contour plots show that the location of the water affected by a +2°C mixing zone varies throughout the tidal cycle. Of the four stages of the tide considered, the +2°C surface contour is greatest at HW with an area of approximately 2.8 km^2. This is relatively small compared with the 95 km^2 area of the Thames and Medway Estuaries and Marshes SPAs and only occurs for a short-lived period on each tide. The area that experiences +2°C excess temperatures at all four stages of the tide is relatively small at 0.5 km^2 and encompasses Damhead Creek, part of East Hoo Creek and part of Slede Ooze.

The +2°C mixing zone does impinge on the Medway Estuary and Marshes SPA, but does not extend to the Thames Estuary and Marshes SPA. The size of the +2°C mixing zone is significantly smaller than that predicted to arise from the operation of the existing station. The typical maximum excess temperature of the CW for the existing plant is +12.3°C. With the same CW flow rate the maximum excess temperature of the new units is only +6.7°C. Therefore the new units offer an improvement in terms of thermal impact of the existing station operating over a similar time period.

There is evidence that (Bamber & Spencer, 1984) that impacts on benthic fauna from the existing Kingsnorth station are limited to some changes in species composition rather than in abundance. It has already been reported that abundance of benthic invertebrates tended to be higher in the most thermally impacted areas. It follows that food sources for wading birdlife, which are the features of conservation interest for the Medway and Thames Estuary sites, would not be threatened by the smaller thermal discharge from the new units.

3.2.4.4.2 Model Results for the New Units, Medway Power and Proposed CCGT at Grain Operating Simultaneously

Excess temperature predictions in the surface layer over a spring tide and a neap tide are shown in Table 3.2.16, whilst those for a spring-neap cycle are shown in Table 3.2.17. All the predictions for this in-combination scenario are greater than for the scenario with only the new units operating, apart from in the Kingsnorth discharge channel where there is no change. It is not surprising excess temperatures are greater when the operation of the proposed Grain CCGT and Medway Power CCGT are included, as the total heat discharged to the estuary is greater than for the scenario in which only the new units operate. Predicted excess temperature statistics are greater over a neap tide than a spring tide.

Note that the statistics are calculated over a two week spring-neap cycle, during which all the stations are operating at full load. Over an annual period the load factors will be less than 100% and temperature predictions would be expected to be less than predicted here.

The greatest increase in average excess temperatures of 1.4°C over the spring-neap cycle for the in-combination scenario compared with the the new units alone scenario occurs at Grain Tower. Grain Tower is relatively close to the Grain outfall and the plume from Grain is advected directly to this point.

Contour plots of the surface temperature resulting from the CW discharges are shown at LW, HW -3 hours, HW and HW+3 hours in Figures 3.2.5a to 3.2.5d respectively. Comparison with Figures 3.2.4a to 3.2.4d shows that the +2°C mixing zone around Kingsnorth is greater for the in-combination scenario. The Grain CW discharge is located such that there is effective advection and dispersal of CW from Grain out to sea on each tide, resulting in lower residual temperature within most of the Medway compared with that caused by Kingsnorth. The operation of Grain does cause a slight increase in far field temperatures near Kingsnorth over many tidal cycles, although the CW discharge from Grain and to a lesser extent Medway Power does not interact directly with the Kingsnorth plume.

Excess temperatures are greater than +2°C for less than half of the spring-neap cycle at TF7. Similar results are predicted over much of Stoke Saltings, which is part of the Medway Estuary and Marshes SPA. However, the site is designated to protect wading birds; it is unlikely that these excess temperatures will limit food sources for for such birds.

Very small areas of the Thames Estuary and Marshes SPA in the vicinity of the Grain discharge may experience excess temperatures of +2°C for short periods of time, although this is largely caused by the CW discharge from Grain, with a negligible contribution from Kingsnorth. The other nearby Natura 2000 sites listed in Section 3.1.9.1 are not expected to experience detectable excess temperatures resulting from the operation of the three power stations.

3.2.4.5 Impacts of Biocide Treatment of Cooling Water

It is necessary to dose CW with a biocide to prevent the growth of marine organisms, such as mussels and algae in the CW system, which would result in a decrease in station efficiency.

At the existing Kingsnorth station, chlorine is introduced into the circulating water system at the CW inlets. Currently Kingsnorth chlorinates only in the summer months.

The EAL for total residual oxidant (as hypochlorite) in estuarine and coastal waters of 10 μg/l is expected to be met comfortably beyond the relatively small mixing zone. Research by the CEGB and JEP (Joint Environmental Programme – the research programme funded by the leading electricity producers in the UK) has shown that any residual biocide decays rapidly on contact with the receiving water (Turnpenny & Coughlan, 2003).

The Reference Document on the application of Best Available Techniques to Industrial Cooling Systems (BREF, 2001) conveys that chlorination of direct cooled systems has been found not to result in significant increases in organo-chlorinated compounds. The current consent for the discharge for the existing station is 0.1 mg/l free chlorine. The BREF (2001) indicates that a value of 0.2 mg/l free residual oxidant as a daily average represents best available techniques for direct cooling systems in saline water. The current consent value is therefore low in comparison with the BREF. It is expected that the new plant will also meet a free chlorine concentration of 0.1 mg/l at the discharge point.

Any dosing regime will be based on past operating experience and will be such that no significant release of residual biocide will occur at the CW outfall.

3.2.4.6 Construction Impacts

No additional abstractions will be required during the construction phase. Potential effects from the construction site include run-off of suspended solids and chemical or oil spillages reaching the power station outfall or contaminated groundwater. These will be managed under an environmental management plan designed to prevent such impacts occurring.

There is a possibility of some water being required for chemical cleaning during the construction of the plant. Any such process will be controlled closely by formal method statements and agreed with the Environment Agency. It is anticipated that there will be very little need for such cleaning with modern manufacturing and construction techniques. Protection of aquifers beneath the power station site will be addressed in the construction environmental management plan, and the appointed contractors will outline methods and requirements. Although there are aquifers deep beneath the power station site, they are not considered at significant risk owing to the intervening layer of low permeability London Clay.

3.2.4.7 Site Drainage

Surface drainage from the development will be discharged via the existing power station drainage system. The on-site storage facilities for limestone and gypsum will be covered. Therefore there will be no suspended solids contribution from rainwater run-off to site drainage from these stores. There should be no contamination of groundwaters at the Kingsnorth site resulting from the proposed development.

3.2.4.8 Mitigation

Water entering and leaving the existing power station is routinely monitored by the power station staff and this will also be the case for the new units, to ensure that the discharges from the power station are managed within limits set by the Environment Agency.

The WWTP will be designed to treat the FGD effluent, by means of pH control and addition of other agents, to precipitate metals from the effluent and so minimise their discharge. The precipitated materials will be re-fired in the power plant, which locks the material into the matrix of the ash formed in combustion – itself forming a useful by-product.

The limestone and gypsum storage areas will be covered so that there will be no contaminated run-off that could find a pathway into any groundwater at the site.

Potential effects from the construction site will be managed under an environmental management plan.

3.2.5 Conclusions

The main aqueous discharge from the new units is the CW discharge, which will also contain the FGD WWTP plant effluent. The main constituent of concern in the actual CW discharge is heat, while the WWTP effluent contains some trace elements. The discharge will easily meet the statutory environmental quality standards for arsenic, mercury and cadmium. Other trace elements are expected to meet the appropriate environmental assessment levels, although these are not statutory limits. There are no statutory temperature limits in estuaries, nor are there any EALs. However the

Environment Agency has produced guidance on assessing the thermal impact of discharges on designated European Marine Sites, which is relevant.

Part of the existing direct cooled system will be re-used by the new units. The proposed new units will release less heat to the estuary per unit of electricity generated than the existing plant.

A three dimensional time-dependent model has been used to simulate advection, dispersion and dissipation of the CW discharged from the new units as the discharge mixes with the receiving water of the estuary. The model predicts:

- The surface area of the receiving water experiencing an excess temperature of +2°C is greater on a neap tide than a spring tide.
- Excess temperatures are greater at the water surface than the estuary bed
- The operation of the new units will not prevent migratory fish from entering or exiting the Medway Estuary.
- Of the Natura 2000 sites in the vicinity of Kingsnorth, only the Medway Estuary and Marshes SPA is predicted to experience an excess temperature of more than +2°C at some stages of the tide owing to the CW discharged from the new units.
- The surface area of the Medway that is predicted to experience at least a +2°C excess temperature throughout the tidal cycle is relatively small at 0.5 km^2 and mainly encompasses the discharge channel itself.
- The 98th percentile temperature in much of the estuary is expected to be approximately 23°C or less.
- Historical experience at the site, coupled with the model results indicate that the CW discharged from the new units will not have a significant beneficial or detrimental effect on the water quality of the estuary
- Furthermore, the effect of the CW discharged from the new units, in addition to that discharged from the proposed CCGT at Grain and the operational Medway Power CCGT is not expected to have a significant beneficial or detrimental effect on the water quality of the estuary.

References

Environment Agency, (2003). Horizontal Guidance Note IPPC H1. July 2003. ISBN 0 11 3101082.

Babbedge N & Taylor M, (2005). European Marine Sites: toxic substances and associated mixing zones. Produced for the Habitats Directive Technical Advisory Group on Water Quality WQTAG083f.

BREF (2001) Integrated Pollution Prevention and Control (IPPC), Reference documents on the application of Best Available Techniques to industrial cooling systems, December 2001.

CEFAS (2004) SmartBuoy Data from the Warp anchorage, www.cefas.co.uk/monitoring, 2004

Turnpenny A W H & Coughlan J, (2003). Using Water Well? Studies of Power Stations and the Aquatic Environment. 2003. ISBN 095171726X.

WQTAG sub group, (2006). Guidance on Assessing the Impact of Thermal Discharges on European Marine Sites. Produced by the Environment Agency

WQTAG sub-group for the Habitats Directive Technical Advisory Group on Water Quality. WQTAG160.

Table 3.2.1 Environmental Assessment Levels from H1

Species	EAL (µg/l)
Arsenic (EQS)	25
Boron	7000
Cadmium (EQS)	5
Chromium	15
Copper	5
Fluoride	5000
Iron	1000
Lead	25
Mercury (EQS)	0.5
Nickel	30
Silver	0.5
Tin	10
Vanadium	100
Zinc	40

Table 3.2.2: Temperature Thresholds for Assessing the impact of Thermal Discharges on SAC/SPA sites

Designation	Deviation from Ambient	Maximum Temperature
SPA	2°C as a Maximum Allowable Concentration (MAC) at the edge of the mixing zone	28°C as a 98th percentile at the edge of the mixing zone
SAC (any designated for estuary or embayment habitat and/or salmonid species)	2°C as a MAC at the edge of the mixing zone	21.5°C as a 98th percentile at the edge of the mixing zone

Taken from WQTAG160

Table 3.2.3: Tidal Levels Referred to Datum of Soundings

Place	Heights in metres above Chart Datum				Chart Datum
	MHWS	MHWN	MLWN	MLWS	
Sheerness	5.8	4.7	1.5	0.6	2.90 m below ODN
Bee Ness	6.0	4.8	1.5	0.6	2.80 m below ODN
Bartlett Creek	5.9	4.7	-	-	2.80 m below ODN
Dartnett Ness	6.0	4.8	1.5	0.5	2.80 m below ODN
Southend-on-Sea	5.8	4.7	1.4	0.5	2.90 m below ODN

Table 3.2.4: Statistics of Daily Temperatures at Warp[1] 2001-2003

Statistic	Warp Temperature (°C)
Maximum	21.5
98th percentile	20.3
95th percentile	19.8
90th percentile	19.3
Mean	12.3
10th percentile	5.9
Minimum	3.9

[1]- CEFAS, SmartBuoy Data from the Warp anchorage, www.cefas.co.uk/monitoring, 2004

Table 3.2.5: Monthly Average of Daily Temperatures at Warp[1] 2001-2003 and Kingsnorth CW Inlet 2004

	Warp Temperature (°C)	Kingsnorth CW Inlet Temperature (°C)
January	5.7	7.5
February	6.1	8.5
March	6.9	9.0
April	8.9	13.4
May	12.3	17.6
June	16.1	20.1
July	18.3	19.6
August	19.9	22.1
September	17.6	18.5
October	14.3	13.9
November	11.1	11.6
December	8.1	10.0
Average	12.3	14.3

[1]- CEFAS, SmartBuoy Data from the Warp anchorage, www.cefas.co.uk/monitoring, 2004

Table 3.2.6: Statistics of Daily Temperatures at Warp[1] 2001-2003, Kingsnorth CW Inlet and Various Points within Medway Estuary

	Warp Anchorage TR10279 85087	CW Inlet TQ80996 71745	Bartlett Creek TQ83500 69700	Elphinstone (LW) TQ86000 73500	Darnett Ness (HW) TQ80300 70800	Darnett Ness (LW) TQ80300 70800	North Kent Buoy (LW) TQ89500 74000	Oakham Ness (LW) TQ842007 1700
Maximum	21.5	22.1	20.3	23.7	26.0	23.2	27.3	24.1
98th percentile	20.3	21.6	22.2	22.6	21.9	22.5	22.6	23.2
95th percentile	19.8	21.0	21.0	22.0	21.0	21.4	21.8	22.0
90th percentile	19.3	20.0	20.3	20.6	20.0	20.3	20.0	20.7
Mean	12.3	14.3	13.1	13.5	12.8	13.2	13.3	13.4
10th percentile	5.9	8.5	6.1	6.0	5.9	6.0	6.1	6.0
Minimum	3.9	7.5	3.4	2.0	2.0	2.0	3.1	2.6

Table 3.2.7: Statistics of Trace Metals Concentration at Kingsnorth CW Outfall

Species	Median (μg/l)	Minimum (μg/l)	Maximum (μg/l)	98th percentile (μg/l)	EAL	Median/EAL (%)
Arsenic	0.800	0.800	31.700	12.870	25.0	3%
Cadmium	0.060	0.040	0.140	0.133	5.0	1%
Chromium	0.330	0.040	2.540	1.623	15.0	2%
Copper	2.400	1.310	4.300	4.174	5.0	48%
Lead	0.620	0.020	4.700	4.301	25.0	2%
Mercury	0.005	0.002	0.028	0.025	0.5	1%
Nickel	1.805	1.160	4.090	4.076	30.0	6%
Selenium	1.000	1.000	8.000	6.670	No EAL	N/A
Vanadium	10.000	10.000	10.000	10.000	100.0	10%
Zinc	11.500	4.250	54.000	40.350	40.0	29%

Table 3.2.8: Ambient Water Quality in the Medway Estuary

Variable	Minimum (mg/l)	Maximum (mg/l)	Typical Seawater (mg/l)
Chloride	15620	17750	19850
Sulphate	2016	2400	2770
Alkalinity (as $CaCO_3$)	125	151	120
pH	7.14	8.60	8

Table 3.2.9 H1 Assessment of Aqueous Discharge from FGD WWTP and CW for Worst Case – Likely Consent Limits and 10 l/s WWTP Flow Rate

Substance	WWTP effluent concentration (µg/l or °C)	Discharge Concentration at CW outfall (µg/l or °C)	PC at outfall (µg/l or °C)	EAL (µg/l or °C)	PC/EAL (%)	Significant?	Background (µg/l or °C)	PEC (µg/l or °C)	PEC/EAL (%)	EQ_i
Aluminium	3600	0.581	0.58	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
ammonical nitrogen	10000	1.615	1.61	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
antimony	80	0.013	0.01	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
arsenic	100	0.016	0.02	25	0.06%	No	0.8	Insignificant	Insignificant	Insignificant
boron	175000	28.258	28.26	7000	0.40%	No	No data	No Data	No Data	Insignificant
cadmium	25	0.004	0.00	5	0.08%	No	0.06	Insignificant	Insignificant	Insignificant
chloride	40000000	6458.905	6458.91	None	No EAL	No EAL	16000000	16006458.9	No EAL	No EAL
chromium	500	0.081	0.08	15	0.54%	No	0.33	Insignificant	Insignificant	Insignificant
copper	150	0.024	0.02	5	0.48%	No	2.4	Insignificant	Insignificant	Insignificant
fluoride	20000	3.229	3.23	5000	0.06%	No	No data	No Data	No Data	Insignificant
iron	1800	0.291	0.29	1000	0.03%	No	No data	No Data	No Data	Insignificant
lead	200	0.032	0.03	25	0.13%	No	0.62	Insignificant	Insignificant	Insignificant
mercury	30	0.005	0.00	0.5	0.97%	No	0.005	Insignificant	Insignificant	Insignificant
molybdenum	2000	0.323	0.32	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
nickel	200	0.032	0.03	30	0.11%	No	1.805	Insignificant	Insignificant	Insignificant
selenium	150	0.024	0.02	None	No EAL	No EAL	1	1.0	No EAL	No EAL
silver	50	0.008	0.01	0.5	1.61%	Yes	No data	No Data	No Data	0.02
suspended solids	30000	4.844	4.84	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
vanadium	100	0.016	0.02	100	0.02%	No	10	Insignificant	Insignificant	Insignificant
zinc	500	0.081	0.08	40	0.20%	No	11.5	Insignificant	Insignificant	Insignificant
Excess Temperature	N/A	6.7	6.7	3	223%	Yes	0	6.7	223%	2.23

EQ_{water}	2.25

Table 3.2.10 Predicted Worst Case Mass Releases from FGD Plant and Possible Consent Limits

Species	Predicted daily mass release from Kingsnorth FGD plant - 100% load factor (kg)	Predicted monthly mass release from Kingsnorth FGD plant - 100% load factor (kg)	80% Monthly load limit for 2000 MW FGD plant (kg)	Predicted annual mass release from Kingsnorth FGD plant - 100% load factor (kg)	Predicted annual mass release from Kingsnorth FGD plant - 80% load factor (kg)	80% Annual load limit for 2000 MW FGD plant (kg)
Aluminium	3.110	93.31	No Limit	1135.3	908.2	No Limit
ammonical nitrogen	8.640	259.20	No Limit	3153.6	2522.9	No Limit
Antimony	0.069	2.07	8.0	25.2	20.2	44.8
Arsenic	0.086	2.59	8.0	31.5	25.2	44.8
Boron	151.200	4536	17600.0	55188	44150	108000
Cadmium	0.022	0.65	1.4	7.9	6.3	8.8
Chloride	34560	1036800	No Limit	12614400	10091520	No Limit
Chromium	0.432	12.96	36.0	157.7	126.1	220
Copper	0.130	3.89	16.0	47.3	37.8	88
Fluoride	17.280	518	No Limit	6307	5046	No Limit
Iron	1.555	46.66	217.6	567.6	454.1	1320
Lead	0.173	5.18	16.0	63.1	50.5	88
Mercury	0.026	0.78	2.0	9.5	7.6	10.4
molybdenum	1.728	51.84	217.6	630.7	504.6	1320
Nickel	0.173	5.18	16.0	63.1	50.5	88
Selenium	0.130	3.89	16.0	47.3	37.8	88
Silver	0.043	1.30	4.0	15.8	12.6	22.4
suspended solids	25.920	778	No Limit	9461	7569	No Limit
Vanadium	0.086	2.59	8.0	31.5	25.2	44.8
Zinc	0.432	12.96	36.0	157.7	126.1	220

Table 3.2.11 H1 Assessment of Aqueous Discharge from FGD WWTP and CW for Design Case – Design Coal with 1.2 l/s WWTP Flow Rate

Substance	WWTP effluent concentration (µg/l or °C)	Discharge Concentration at CW outfall (µg/l or °C)	PC at outfall (µg/l or °C)	EAL (µg/l or °C)	PC/EAL (%)	Significant?	Background (µg/l or °C)	PEC (µg/l or °C)	PEC/EAL (%)	EQ_i
Aluminium	3600	0.0681	0.068	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
ammonical nitrogen	10000	0.1892	0.189	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
Antimony	80	0.0015	0.002	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
Arsenic	100	0.0019	0.002	25	0.01%	No	0.8	Insignificant	Insignificant	Insignificant
Boron	175000	3.3109	3.311	7000	0.05%	No	No data	No Data	No Data	Insignificant
Cadmium	25	0.0005	0.000	5	0.01%	No	0.06	Insignificant	Insignificant	Insignificant
Chloride	40000000	756.7658	756.766	None	No EAL	No EAL	16000000	16000756.8	No EAL	No EAL
Chromium	500	0.0095	0.009	15	0.06%	No	0.33	Insignificant	Insignificant	Insignificant
Copper	150	0.0028	0.003	5	0.06%	No	2.4	Insignificant	Insignificant	Insignificant
Fluoride	20000	0.3784	0.378	5000	0.01%	No	No data	No Data	No Data	Insignificant
Iron	1800	0.0341	0.034	1000	0.00%	No	No data	No Data	No Data	Insignificant
Lead	200	0.0038	0.004	25	0.02%	No	0.62	Insignificant	Insignificant	Insignificant
Mercury	30	0.0006	0.001	0.5	0.11%	No	0.005	Insignificant	Insignificant	Insignificant
molybdenum	2000	0.0378	0.038	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
Nickel	200	0.0038	0.004	30	0.01%	No	1.805	Insignificant	Insignificant	Insignificant
Selenium	150	0.0028	0.003	None	No EAL	No EAL	1	1.0	No EAL	No EAL
Silver	50	0.0009	0.001	0.5	0.19%	No	No data	No Data	No Data	Insignificant
suspended solids	10500	0.1987	0.199	None	No EAL	No EAL	No data	No Data	No EAL	No EAL
Vanadium	100	0.0019	0.002	100	0.00%	No	10	Insignificant	Insignificant	Insignificant
Zinc	500	0.0095	0.009	40	0.02%	No	11.5	Insignificant	Insignificant	Insignificant
Excess temperature	40	6.7	6.700	3	223.33%	Yes	0	6.7	223.3%	2.23

EQ_{water}	2.23

Table 3.2.12 Predicted Design Coal Mass Releases from FGD Plant and Possible Consent Limits

Species	Predicted daily mass release from Kinsnorth FGD plant - 100% load factor (kg)	Predicted monthly mass release from Kingsnorth FGD plant - 100% load factor (kg)	80% Monthly load limit for 2000 MW FGD plant (kg)	Predicted annual mass release from Kingsnorth FGD plant - 100% load factor (kg)	Predicted annual mass release from Kingsnorth FGD plant - 80% load factor (kg)	80% Annual load limit for 2000 MW FGD plant (kg)
Aluminium	0.364	10.93	No Limit	133.0	106.4	No Limit
Ammonical nitrogen	1.012	30.37	No Limit	369.4	295.6	No Limit
Antimony	0.008	0.24	8.0	3.0	2.4	44.8
Arsenic	0.010	0.30	8.0	3.7	3.0	44.8
Boron	17.713	531	17600.0	6465	5172	108000
Cadmium	0.003	0.08	1.4	0.9	0.7	8.8
Chloride	4049	121461	No Limit	1477772	1182217	No Limit
Chromium	0.051	1.52	36.0	18.5	14.8	220
Copper	0.015	0.46	16.0	5.5	4.4	88
Fluoride	2.024	61	No Limit	739	591	No Limit
Iron	0.182	5.47	217.6	66.5	53.2	1320
Lead	0.020	0.61	16.0	7.4	5.9	88
Mercury	0.003	0.09	2.0	1.1	0.9	10.4
Molybdenum	0.202	6.07	217.6	73.9	59.1	1320
Nickel	0.020	0.61	16.0	7.4	5.9	88
Selenium	0.015	0.46	16.0	5.5	4.4	88
Silver	0.005	0.15	4.0	1.8	1.5	22.4
suspended solids	1.063	32	No Limit	388	310	No Limit
Vanadium	0.010	0.30	8.0	3.7	3.0	44.8
Zinc	0.051	1.52	36.0	18.5	14.8	220

Table 3.2.13 CW Discharge Characteristics

Station	CW flow rate (m^3/s)	Temperature (°C)[1]	Excess Temperature (°C)
Existing 1940MW Kingsnorth station	61.92	18.3	+12.3
1600MW new units at Kingsnorth	61.92	12.7	+6.7
Medway Power 700MW tower cooled CCGT	0.52	22.0	+16
Grain CCGT (1200MW)	18	18.5	+12.5

[1] – ambient temperature 6°C

Table 3.2.14: Predicted Average and Maximum Surface Excess Temperatures over a Spring and a Neap Tide – New Units

DELFT3D run ID k11 & k12	Spring Tide[1]		Neap Tide[2]	
	Average Excess Temperature (°C)	Maximum Excess Temperature (°C)	Average Excess Temperature (°C)	Maximum Excess Temperature (°C)
Grain Spit	+0.2	+0.5	+0.3	+0.3
Sheerness	+0.3	+0.5	+0.5	+0.7
Grain Tower	+0.4	+0.6	+0.3	+0.5
Blackstakes	+0.7	+1.0	+0.8	+1.2
TF7	+1.6	+2.5	+1.4	+1.9
Bee Ness Jetty	+1.3	+4.7	+2.2	+5.3
Oakham Ness Jetty	+1.3	+5.5	+1.7	+4.1
DC5	+6.6	+6.7	+6.6	+6.7
Bartlett Creek	+1.1	+1.2	+1.5	+1.7
Darnett Ness	+1.1	+1.4	+1.7	+2.0
Chatham	+1.2	+1.3	+1.4	+1.8

[1]- statistics calculated from HW 02:00 6 January to HW 03:00 7 January 2003 on an hourly basis
[2]- statistics calculated from HW 08:00 13 January to HW 09:00 14 January 2003 on an hourly basis

Table 3.2.15: Predicted Average and Percentile Surface Excess Temperatures over a Spring-Neap Cycle – New Units

DELFT3D run ID k11 & k12	Spring-Neap Cycle[1]		
Location	**Average Excess Temperature (°C)**	**95th percentile Excess Temperature (°C)**	**98th percentile Excess Temperature (°C)**
Grain Spit	+0.2	+0.5	+0.5
Sheerness	+0.3	+0.6	+0.6
Grain Tower	+0.4	+0.5	+0.6
Blackstakes	+0.8	+1.1	+1.2
TF7	+1.6	+2.5	+2.6
Bee Ness Jetty	+1.7	+4.2	+5.3
Oakham Ness Jetty	+1.4	+4.1	+4.8
DC5	+6.6	+6.7	+6.7
Bartlett Creek	+1.2	+1.5	+1.7
Darnett Ness	+1.3	+1.7	+1.8
Chatham	+1.3	+1.6	+1.7

[1]- statistics calculated from 00:00 1 January to 00:00 15 January 2003 on an hourly basis

Table 3.2.16: Predicted Average and Maximum Surface Excess Temperatures over a Spring and a Neap Tide – New Units

DELFT3D run ID k148 & k49	Spring Tide[1]		Neap Tide[2]	
	Average Excess Temperature (°C)	**Maximum Excess Temperature (°C)**	**Average Excess Temperature (°C)**	**Maximum Excess Temperature (°C)**
Grain Spit	+0.5	+1.0	+0.6	+1.1
Sheerness	+0.4	+0.8	+0.9	+1.1
Grain Tower	+1.4	+2.0	+2.4	+4.3
Blackstakes	+1.0	+1.5	+1.4	+1.8
TF7	+2.0	+2.8	+1.8	+2.2
Bee Ness Jetty	+1.7	+4.9	+2.6	+5.3
Oakham Ness Jetty	+1.7	+5.7	+2.1	+4.3
DC5	+6.6	+6.7	+6.6	+6.7
Bartlett Creek	+1.4	+1.5	+1.8	+2.0
Darnett Ness	+1.5	+1.7	+2.0	+2.3
Chatham	+1.5	+1.6	+1.7	+2.1

[1]- statistics calculated from HW 02:00 6 January to HW 03:00 7 January 2003 on an hourly basis
[2]- statistics calculated from HW 08:00 13 January to HW 09:00 14 January 2003 on an hourly basis

Table 3.2.17: Predicted Average and Percentile Surface Excess Temperatures over a Spring-Neap Cycle – New Units

DELFT3D run ID k48 & k49	**Spring-Neap Cycle[1]**		
Location	**Average Excess Temperature (°C)**	**95th percentile Excess Temperature (°C)**	**98th percentile Excess Temperature (°C)**
Grain Spit	+0.5	+1.0	+1.1
Sheerness	+0.6	+1.1	+1.1
Grain Tower	+1.8	+3.4	+3.8
Blackstakes	+1.2	+1.6	+1.6
TF7	+2.0	+2.8	+2.9
Bee Ness Jetty	+2.1	+4.3	+5.4
Oakham Ness Jetty	+1.8	+4.2	+4.9
DC5	+6.6	+6.7	+6.7
Bartlett Creek	+1.5	+1.8	+1.9
Darnett Ness	+1.7	+2.0	+2.1
Chatham	+1.6	+1.9	+2.0

[1]- statistics calculated from 00:00 1 January to 00:00 15 January 2003 on an hourly basis

3.3 By-products and Solid Waste

3.3.1 Introduction

This section describes the by-products and solid wastes produced as a result of constructing and operating Kingsnorth units 5 and 6, and means of their disposal.

3.3.2 Generation of By-products and Waste

3.3.2.1 During Construction

The construction of the new units will produce certain amounts of spoil from ground excavations. This will be used around the site to aid landscaping (which will assist in minimising the number of construction traffic movements) or will be disposed of at a suitable licensed disposal site. Any other waste produced will be managed in accordance with an Environmental Management Plan.

3.3.2.2 Operational Impacts

The burning of coal produces two types of ash:

- Furnace Bottom Ash (FBA)
- Pulverised Fuel Ash (PFA)

Operation of the flue gas desulphurisation plant (FGD) produces gypsum, but also filter cake from dewatering the sludge in its gypsum waste water treatment plant.

The ash and gypsum are considered as saleable by-products and do not normally have to be disposed of as waste. The filter cake has to be disposed of.

3.3.3 Ash

3.3.3.1 Furnace Bottom Ash

Furnace Bottom Ash (FBA) is formed from an inorganic material with a small proportion of carbon particles resulting from combustion of coal. It is usually produced when ash adheres as hot particles to the furnace walls, agglomerates and then falls down to the furnace base, where it can be removed (ADDA, 2002). It has similar chemical compositions to Pulverised Fuel Ash. However, FBA ranges in grain size from fine particulate matter to coarse lumps and is dark grey to black in appearance (UKQAA, 2004).

From a worst case, assuming a 90% load factor it is expected that approximately 88k tonnes of FBA will be produced annually. It is anticipated that it will be sold for commercial applications such as block making, road construction and construction infill.

Any FBA that has not been sold will be treated as a waste product from the process. The EU Commission Decision 2000/532/EC which establishes the criteria and procedures for acceptance at landfills has been implemented by The List of Wastes (England) Regulations 2005 (SI/895). FBA is classified under Code 10 01 01 (*Wastes from thermal processes; waste from power stations and other thermal combustion plants; bottom ash, slag and boiler dust*).

FBA has been classified as inorganic and non-hazardous. However, there has been a change to the classification of a likely component of the FBA. Almost certainly, zinc will be present, commonly as zinc oxide amongst other zinc substances. Ash, as with other wastes, will need to meet Waste Acceptance Criteria testing thresholds before being accepted for landfill (Environment Agency, 2006).

FBA will not be stored on site. It is expected to be sold and transported away from the site by road, using the appropriate dust mitigation measures.

3.3.3.2 Pulverised Fly Ash

Pulverised Fly Ash (PFA) is formed from an inorganic material with a small proportion of carbon particles resulting from combustion of coal. It is trapped in the electrostatic precipitators from which it is then removed. Around 60-90% of PFA is present as an amorphous glassy material, composed of silica, alumina and iron oxides, with other metals present in small quantities. It has similar chemical compositions to FBA. However, PFA usually consists of very fine particulate matter of even consistency and is light grey in appearance (UKQAA, 2004).

The combustion process will produce high quality PFA as a by-product, i.e containing less than 5% carbon in ash by mass and less than 12% by weight of 45µin sieve particle size. From a worst case, assuming a 90% load factor it is expected that approximately 263k tonnes of FBA will be produced annually. It is anticipated that it will be sold for commercial applications in the construction industry.

Similarly to FBA, in the unlikely event that PFA is not sold it will be treated as a waste. It is listed in The List of Wastes (England) Regulations 2005 (SI/895) and is classified under Code 10 01 02 (*Wastes from thermal processes; waste from power stations and other thermal combustion plants; coal fly ash*). Available leachate elements are minimal, non-odorous, non-hazardous material and therefore it could be landfilled at a suitably licensed site, as a final option.

3.3.4 FGD Gypsum

3.3.4.1 Gypsum

The limestone/gypsum FGD process proposed will produce high-grade gypsum as a by-product. With gypsum contents of over 95%, it is anticipated that this material will be sold for commercial applications. Typically, all FGD gypsum produced in the UK is sold to industry for plasterboard or other building product manufacture.

Gypsum ($CaSO_4.2H_2O$) is the hydrated form of calcium sulphate ($CaSO_4.2H_2O$) and during the FGD process is produced by interaction of the hot flue gases with fine spray limestone slurry in an absorber tower. This is subsequently de-watered to provide a by-product suitable for sale. It is anticipated that about 79k tonnes of gypsum will be produced each year. It will be transported from site by boat.

Any gypsum that is not sold will be treated as a waste product from the process. FGD gypsum is included in the EU Commission Decision 2000/532/EC (as amended) establishing a list of wastes. It is classified under Code 10 01 05 (*Wastes from thermal processes; wastes from power stations and other combustion plants; calcium based reaction wastes from flue gas desulphurisation in solid form*).

Specific reference is made to gypsum waste in the EU Council Decision 2003/33/EC, which establishes the criteria and procedures for acceptance of waste at landfills. Annex item 2.2.3 requires such waste to be "*deposited only in landfills for non-hazardous waste in cells where no biodegradable waste is accepted*". The reason for excluding it from biodegradable landfills is due to its potential to produce hydrogen sulphide if co-disposed with organic wastes.

3.3.5 Filter Cake

The filter cake from the waste-water treatment plant is basically gypsum, but has been treated, by means of pH control and addition of other agents, to precipitate metals from the effluent and so minimise their discharge with the waste water. It therefore contains insoluble compounds such as metal hydroxides and sulphides, and iron chlorides. It is proposed to burn the filter cake with the coal in the boilers, as occurs in a similar manner at other power stations with FGD plant. The precipitated materials will be locked into the matrix of the ash formed in combustion. The ash is then a useful product.

3.3.6 Ash Sales

All of the FBA for the existing units is sold to the construction industry, mostly for road construction. There is a significant demand for this type of ash within this industry.

All of the PFA is expected to be sold due to its improved quality due to improvements in technology and materials handling. Furthermore, increased housing demand and other large construction projects in the south east of England means that there is a foreseeable market demand into the future. The ash from Kingsnorth units 5 and 6 is therefore suitable for a wider market than previously experienced.

E.ON UK is seeking long-term ash sales options in the locality, although more specific details cannot be provided at present.

PFA and FBA will be sold, wherever possible. E.ON UK has successfully sold an average of over 85% of ash produced in the period 2001 – 2005 and this is published in its Corporate Social Responsibility Report. There is likely to be a high demand for ash from Kingsnorth in the south east of England so this level of sales, or even higher, should be maintained.

Due to the diverse nature and location of customers, all ash will continue to be transported by road. This also reflects previous discussions with Medway Council, early in the planning process. The quantity of ash produced is likely to be lower than from the existing units. The transport assessment (see Chapter 3.7) includes a worst case assessment of this.

PFA will be stored temporarily in silos rather than in ash lagoons, such as the existing ones on the East of the site. It will then be transported in sealed tankers, rather than in covered lorries which are currently used. This will ensure that PFA quality is maintained and will reduce dust issues that are occasionally experienced with current operations. The improved quality of ash means that it is applicable to a wider range of uses.

FBA will continue to be sold as present, and transported by road in covered lorries.

Where PFA and FBA cannot be sold, as a final option, ash will be disposed of at landfill using road transport. Suitably licensed sites are being explored in the locality, thereby removing the ash out of the immediate area.

The existing ash storage lagoons will not be used for the operation of the new units. There is potential for a restoration and landscaping project for this area, although this will require a separate planning application. This will be subject to future discussions about those parts of the site which are not required for operational land for the new units.

3.3.7 Conclusions

The materials produced in the new units which will be sold are:

- Pulverised fly ash
- Furnace bottom ash
- Gypsum

The main wastes produced as a result of this development are:

- Spoil during construction - Spoil will be utilised where possible for on-site landscaping.
- Ash and gypsum - Only under exceptional circumstances is it expected that ash or gypsum will have to be disposed of in landfill sites.
- Wastewater treatment filter cake.

  Filter cake is proposed to be burned in the boilers of the new units.

References

ADDA (Ash Development Association of Australia), 2002. *Utilisation*. ADDA: Wollongong NSW. Available at: http://www.adaa.asn.au/utilisations.htm

E.ON UK, 2005. Waste and by-product management. *E.ON UK Corporate Social Responsibility Report*. E.ON UK: Coventry. Available at: http://www.eon-uk.com/726.aspx

UKQAA (United Kingdom Quality Ash Association), 2004. *Technical Data Sheet 9.0: PFA/Fly Ash and FBA Material Datasheet*. COSHH Health and Safety information sheet. UKQAA: Wolverhampton. Available at: http://www.ukqaa.org.uk/Datasheets_PDF/Datasheet_9-0_Aug_2004.pdf

3.4 Flood Risk

The Kingsnorth site is protected by an existing flood defence system. Strengthening of the system was undertaken in 1987 when the flood wall on the southern extremity of the site adjacent to the River Medway was improved. At that time the standard was to defend against 1 in 200 year flood for 'soft' defences and 1 in 1,000 year flood for 'hard' defences.

A large proportion of the power station main buildings are within 100m of the estuary lying within the functional floodplain with some structures including the Long Reach jetty located in the water. The power station site is identified as being located within a flood warning area. The site is classified as a Zone 3 flood risk site which represents the likelihood of flooding in one year as 0.5%.

The site levels range between 2m and 3m above Ordnance Datum Newlyn (ODN). The Environment Agency (EA) identified in 2006 that the 1 in 200 year high water level is 5.4m ODN and the 1 in 1000 year high water level is 5.8m ODN. These figures are still water levels with a design year horizon of 2060. Flood defences designed to withstand a 1 in 200 year or 1 in 1000 year high water level must additionally account for storm and tidal surges, wave height and intensity; the effect of climate change (rises on sea level) is already accounted for in the still water level. This means that the actual height of defences may need to be higher than the quoted still water levels in order to provide protection to the required standard.

An extensive Flood Risk Assessment (FRA) was conducted in 2003 as part of the planning process for FGD plant for the existing units. The report stated that the EA flood levels were 6.2m ODN for a 1 in 1000 year flood event and 5.8m ODN for a 1 in 200 year event, which are considerably higher than those stated above.

During a recent review by E.ON UK the EA was contacted over the discrepancy in the figures provided in 2003 and 2006. The EA confirmed that the figures supplied in February 2006 quoting the 1 in 200 year standard as 5.4m ODN and the 1 in 1000 year standard as 5.8m ODN were correct and that the discrepancy arose from using different base points to supply the data. The 2003 figures are referenced to Lower Hope Point in Higham which is no longer considered a suitable base point by the EA given its location. The 2006 figures are referenced to Darnet Ness near Darnet Fort which is the nearest EA monitoring point to the power station site. The 2006 figures have therefore been used to assess the adequacy of the flood defences at the power station site.

The east and southern site boundaries are bounded by primary defences. The southern boundary is protected by a concrete sea wall and the eastern boundary up to the closure with the Damhead Creek defences is a concrete pile wall with a concrete cap. These primary defences are maintained by the EA. The north and western site boundaries are protected by secondary defences in the form of ash embankment bunds.

The flood defences at Kingsnorth underwent strengthening and general maintenance works in 1987. A topographical survey undertaken as part of the 2003 assessment confirmed that the majority of the defences were robust, well engineered and in reasonable condition. Some areas of local weakness were identified and remedial works recommended.
Following work undertaken to the primary defences in 2004 the main station buildings are fully enclosed by flood defences. The defences do not however provide protection to the ash lagoons.

Work is currently underway to construct bunds around the lagoons to an EA agreed construction height of 6.3m ODN. The bunds are being constructed of PFA laid and compacted in line with current standards and best practice.

The primary sea defences comprise a concrete wall which extends along the southern site boundary fronting the Medway; this wall stops at the interceptor on the ash road. The works undertaken in 2004 closed a gap in the line of the defence at this location.

Embankment bunds are compliant to the 1 in 200 year standard with the majority of bunds being 5.7m ODN or higher, some 300mm greater than the required minimum. One area of weakness is where the main site access road forms part of the bund where the road level is only 4.9m. It is recommended that the road is raised in this area or a suitable stop gap detail introduced.

The defences which run along the boundary with Damhead Creek are generally in good condition. The closure between the Damhead Creek defences and Kingsnorth defences is good with the height of the defences being in the region of 6m at the point of closure.

All of the earth bunds show signs of animal activity which although unsightly does not, at the present time, undermine the structural integrity of the defences. A suitable maintenance regime will be adopted to ensure that continuing animal activity does not adversely affect the structural integrity of the defences.

The EA's records state that the site was affected by the 1953 East Coast floods. There are no records held by the EA or at the power station to suggest that the site has flooded since 1953.

Overall, the consultations with the Environment Agency and conclusions of the flood risk assessment have concluded that the Kingsnorth power station site is fully protected to current flood risk standards, with some requirements for minor repair and maintenance work. The maintenance work would not exacerbate flood risk elsewhere and would have no significant environmental impact. The new units would be satisfactorily protected against flood damage.

3.5 Ecology

3.5.1 Terrestrial Ecology

3.5.1.1 Introduction

3.5.1.1.1 Terms of Reference

Young Associates (Environmental Consultants) Ltd was commissioned in March 2006 by E.ON UK plc to undertake terrestrial and freshwater ecology surveys to inform development proposals on land at Kingsnorth power station, Isle of Grain, Kent.

In September 2006 the commission was extended to include production of an Ecological Impact Assessment for two new high efficiency coal-fired units (known as Units 5 and 6) on the site. This Ecological Impact Assessment, which will form part of the Environmental Statement to be submitted with a planning application for Units 5 and 6, has been produced in accordance with the requirements of the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000. Its aim is to provide independent advice to E.ON UK plc, the planning authorities, statutory bodies and other interested stakeholders on the potential effects of the development on the nature conservation interest of the site and adjacent areas.

3.5.1.1.2 Objectives of the Ecological Impact Assessment

In accordance with the requirements of the Regulations, the aims of this Ecological Impact Assessment are as follows:

- to describe and evaluate the baseline ecological status of the application site;
- to assess the potential for significant ecological impacts likely to arise from the construction and operation of the proposed new units;
- to propose appropriate mitigation and enhancement measures, and;
- to assess the significance of any residual ecological impacts identified.

The statutory nature conservation organisation, Natural England, indicated in its response to the Scoping Study for the scheme that an “appropriate assessment” of the impacts of Units 5 and 6, in combination with other policies and plans, on the conservation objectives of the Medway Estuary and Marshes European site will be required. The Ecological Impact Assessment therefore also contains information to assist the Competent Authority, i.e. the Department for Trade and Industry, in making this assessment.

3.5.1.1.3 Legislative and Planning Policy Context

National Planning Policy and Legislation

Guidance on nature conservation planning policy is provided in the Office of the Deputy Prime Minister’s **Planning Policy Statement 9: Biodiversity and Geological Conservation** (PPS9, 2005). This is concerned with protection through the planning system of statutory and non-statutory sites of biodiversity and/or geological conservation value, as well as species protection and biodiversity

conservation in the wider environment. The general objective is to conserve, enhance and restore the diversity of England's wildlife and geology.

PPS9 sets out a number of key principles, which include the need for up-to-date baseline information; the need for biodiversity to be taken into account at all scales of development planning; the need for appropriate weight to be attached to biodiversity in decision-making; the need to prevent harm to biodiversity and geological interests and the need to promote opportunities for enhancement.

In considering biodiversity issues, PPS9 places particular emphasis on the requirement for local authorities to pay due regard to the conservation and enhancement of habitats and species listed under section 74(2) of the **Countryside and Rights of Way Act (CRoW) 2000** as being of *"principal importance for the conservation of biological diversity in England"*. This list can be viewed on the DEFRA website at www.defra.gov.uk. If there is likely to be an effect on a protected species, adequate mitigation must be put in place prior to planning permission being granted.

The Government Circular to accompany PPS9 states that the presence of a protected species is "*… a material consideration when a planning authority is considering a development proposal which, if carried out, would be likely to result in harm to the species or its habitat*". National legislation for the special protection of selected species is provided in the **Wildlife and Countryside Act 1981**, as amended. Under Section 1(1) and 1(2), all British bird species, their nests and eggs (excluding some pest and game species) are protected from intentional killing, injury or damage. Under Sections 1(4) and 1(5), special penalties are applied to bird species included in Schedule 1 of the Act and protection is extended for these species to disturbance to birds whilst building, in or near a nest and disturbance to dependant young. Schedule 5 provides special protection to selected animal species other than birds, through paragraph 9(4) of the Act, against damage to "*any structure or place which any wild animal* (included in the schedule) *uses for shelter and protection*" and against disturbance whilst in such places. The **CRoW Act 2000** amends Section 1(5) of the Wildlife and Countryside Act 1981 by introducing a new offence *of "reckless"* disturbance to protected wildlife and making certain offences punishable by imprisonment.

The **Protection of Badgers Act 1992** provides protection to badgers and their setts.

A number of animal species are provided additional protection through inclusion on Schedule 2 of **The Conservation (Natural Habitats, &c.) Regulations 1994**, which transpose into British law the European Community's **Habitats Directive (92/43/EEC)**. The Regulations, commonly referred to as the "Habitats Regulations", extend protection against deliberate disturbance to those animals wherever they are present, and provides tests against which the permission for a development that may have an effect on a Schedule 2 protected species must be assessed before permission can be given. A species in this category that is of particular relevance to the Kingsnorth site is the great crested newt *Triturus cristatus*.

Regional Spatial Strategy

Following the enactment of the **Planning and Compulsory Purchase Act 2004**, Regional Planning Guidance (RPG) has become part of the statutory development plan and has been re-named as a Regional Spatial Strategy (RSS). **RPG9**, which currently covers the south east of England, was published in March 2001 and covers the period to 2016. It includes, at Chapter 6 *"Environmental Strategy and the Countryside"*, policies relating to the protection of designated sites, biodiversity and woodland. A draft **South East Plan**, which covers the period from 2006 to 2026, was formally submitted to government in March 2006 and, when adopted (expected in early 2008), will replace RPG9. This document contains Section D5, *"Sustainable Natural Resource Management"*, which includes policies on biodiversity.

Structure Plan

The relevant structure plan for the area is the **Kent and Medway Structure Plan** which was adopted in July 2006 and provides for development and change in Kent up to 2021. It includes Chapter 4 *"Protecting and Enhancing our Natural Environment"* and Chapter 9 *"Managing our Natural Resources"*, which contain the following nature conservation policies relevant to the proposals.

- **Policy EN6**: International and National Wildlife Designations;
- **Policy EN8**: Protection, Conservation and Enhancement of Biodiversity.

Local Plan and Local Development Framework

The Local Plan for the Area is the **Medway Local Plan** which was adopted in May 2003. 2003. This contains Chapter 3 *"Built and Natural Environment"*, which contains the following policies relevant to nature conservation:

- **Policy BNE 35**: International and National Nature Conservation Sites;
- **Policy BNE 37**: Wildlife Habitats;
- **Policy BNE 39**: Protected Species.

Supplementary Planning Guidance

The Kent and Medway Structure Plan contains supplementary planning guidance on Biodiversity Conservation (**SPG2**), which was adopted in July 2006.

Biodiversity Action Plans

Biodiversity Action Plans (BAPs) are part of the British government's strategy for the implementation of the 1992 Convention on Biological Diversity, to which it is a signatory. BAPs have been developed for the UK and devolved to local levels (LBAPs), to protect a number of rare species and habitats and reverse the declines of more widespread, but declining, species and habitats. Under the CRoW Act 2000, the English government has a duty to have due regard to the purpose of conserving biodiversity, so it is good practice for BAP and LBAP species and habitats to be taken into consideration in the planning of a development scheme.

In addition to the overall UK BAP, the area affected by the proposal is covered by the **Kent BAP** (Kent BAP Steering Group 1997).

3.5.1.2 Consultations and Review of Data

3.5.1.2.1 Scoping Statement

An Environmental Impact Scoping Statement was produced by E.ON UK plc in October 2006. The proposals for the development set out in that document have, insofar as possible, taken into consideration the existing nature conservation interest of the site.

The scope of the ecological surveys undertaken to inform the Ecological Impact Assessment have been discussed with the relevant statutory agency, Natural England.

3.5.1.2.2 Desk Study and Consultations

As part of the commission, a review of previous publications on the site and surrounding land was undertaken. The following reports were reviewed, as follows:

- ERM (1996). **Kingsnorth Integrated Waste Management Facility Environmental Statement**. Report to PowerGen.
- Roberts, P.J. (April 1988). **Ornithological Studies at Kingsnorth. Breeding Birds**. Kingsnorth "B" Pre-application Studies report by Henderson Ecological Consultants for the Central Electricity Generating Board.
- Henderson, A.C.B. and Roberts, P.J. (August 1988). **Kingsnorth Terrestrial Ecology Studies**. Kingsnorth "B" Pre-application Studies report by Henderson Ecological Consultants for the Central Electricity Generating Board.
- Henderson, A.C.B. and Roberts, P.J. (September 1988). **Ornithological Studies at Kingsnorth. Wintering Birds**. Kingsnorth "B" Pre-application Studies report by Henderson Ecological Consultants for the Central Electricity Generating Board.

A consultation and data collection exercise for the assessment was also undertaken. The following organisations and individuals were consulted:

- Natural England – R. Moberly;
- E.ON UK plc Environmental Initiatives Officer at Kingsnorth – B. Jones;
- Medway Council – Peter Zwozdiac;
- Kent Wildlife Trust (KWT) – A. Riggs;
- Kent and Medway Biological Records Centre (KMBRC);
- RSPB *****
- British Trust for Ornithology – Wetland Birds Survey Officer;
- Kent Reptile and Amphibian Group (KRAG) – R. Hodges;
- Kent Bat Group – S. Thompson;
- West Kent Badger Group – B. Wilkinson; and
- Local Bird Recorder ***** – Derek Tutt
- ScottishPower – owners of the adjacent Damhead Creek power station.

* At the time of writing this report, responses had not yet been received from the consultees marked with an asterisk.

3.5.1.2.3 Statutory Designated Nature Conservation Sites

Information on statutory sites was obtained from the government website, magic.gov.uk and the websites of the statutory agencies Natural England (naturalengland.org.uk) and the Joint Nature Conservation Committee (jncc.gov.uk). Immediately surrounding the application site to the west, south and east is the **Medway Estuary and Marshes**, which has three statutory designations: Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar Site. The SSSI citation and Natura forms for the SPA and Ramsar Site are provided at Appendix D1.

Most of the land at Kingsnorth power station, including almost all of the application site, is outside of the SSSI/SPA/Ramsar site. However, the Longreach Jetty, along which conveyors for limestone and gypsum are proposed, extends into the midstream of the Medway Estuary, so this small part of the application site does lie within this designated area.

Medway Estuary and Marshes SSSI

Kingsnorth power station is surrounded to the west, south and east by the **Medway Estuary and Marshes SSSI**, which is a statutory designated site extending to 6,840 ha. SSSIs are designated under Section 28 of the Wildlife and Countryside Act 1981, as amended, and SSSIs provide a national series of protected sites intended to conserve the best examples of the full range of habitats and species present across all regions of Great Britain. A SSSI is therefore evaluated in nature conservation terms as a nationally important site.

The qualifying features for which the Medway Estuary and Marshes is designated as a SSSI are the range of flora and fauna, especially birds, associated with the estuary's extensive complex of mudflats, saltmarsh and grazing marsh.

Most of E.ON UK's landholding at Kingsnorth is excluded from the SSSI designation, but the company does own two areas of the SSSI locally. One is a small part of the grazing marsh to the west of the application site (part of Unit 49 of the SSSI), and the other is an island in the Estuary, known as Oakham Marshes (part of Unit 100 of the SSSI). This area, which is also outside of the application site, is at the furthest eastern extent of E.ON UK's ownership. Oakham Marshes is managed for the benefit of nature conservation by E.ON UK's Environmental Initiatives Officer, who is based at Kingsnorth power station.

Medway Estuary and Marshes SPA

Parts of the SSSI around the cooling water outfall at Damhead Creek, and to the south and west of the application site are additionally designated as the Medway Estuary and Marshes SPA. SPAs are areas of international nature conservation value classified in accordance with Article 4 of EC Directive 79/409/EEC on the conservation of wild birds (commonly known as the "Birds Directive") and designated as "European sites" under Regulation 10 of the Habitats Regulations. Under Regulation 48 the potential implications of development proposals on the integrity of

an SPA must be assessed by a Competent Authority (in the case of this power station the Department for Trade and Industry is the Competent Authority) before granting planning consent. In making such an assessment, referred to as an "appropriate assessment", decision-makers must take into account the conservation objectives of the European site. In this case the draft conservation objectives are to maintain, and if possible enhance, the habitats supporting the bird populations for which the SPA is designated.

In this case the draft conservation objectives are to maintain, and if possible enhance, the habitats supporting the bird populations for which the SPA is designated.

The Medway Estuary and Marshes SPA extends to 4,684 ha in total, and comprises the River Medway and the complex of mud and sand flats, saltmarsh, lagoons, grassland and wetland habitats associated with the estuary. The SPA as a whole qualifies for designation under Article 4.1 of the Birds Directive by regularly supporting a breeding population of European importance of three species, and over-wintering populations of European importance of two species, as follows:

- Avocet *Recurvirostra avocetta* 6.2% of the GB breeding population;
- Little tern *Sterna albifrons* 1.2% of the GB breeding population;
- Common tern *Sterna hirundo* 0.6% of the GB breeding population.
- Bewick's swan *Cygnus columbianus bewickii* 0.2% of GB wintering population;
- Avocet 24.7% of GB wintering population.

The SPA also qualifies under Article 4.2 for internationally important wintering populations of a further 16 named species and also for its internationally important assemblage of birds (breeding and overwintering).

Medway Estuary and Marshes Ramsar Site

The Medway Estuary and Marshes Ramsar site extends to 4,697 ha in total, and also comprises the River Medway and the complex of mud and sand flats, saltmarsh, lagoons, grassland and wetland habitats associated with the estuary. The site qualifies for designation under criterion 2, of the Ramsar Convention, i.e. for a number of rare plants and invertebrates, including at least 12 British Red Data book species of wetland invertebrate. It also qualifies under criterion 5 for an internationally important assemblage of wintering wildfowl, and under criterion 6 for a number of named bird species. These are, for spring/autumn peak counts:

- Grey plover *Pluvialis squatarola* 1.2% of the population;
- Common redshank Tringa tetanus tetanus 1.4% of the population.

And, for winter peak counts of:

- Dark-bellied brent goose *Branta bernicula bernicula* 1.1% of the population;
- Common shelduck *Tadorna tadorna* 3.3% of the population;

- Northern pintail *Anas acuta* 1.8% of the population;
- Ringed plover *Charadrius hiaticula* 1.6% of the population;
- Red knot *Calidris canutus islandica* 1.0% of the population;
- Dunlin *Calidris alpina alpina* 1.4% of the population.

Conservation Objectives of the Medway Estuary and Marshes European Site

The statutory agency, Natural England's conservation objectives for the Medway Estuary and Marshes European site, which comprises both the SPA and the Ramsar site, are as follows:

To maintain[1], in favourable condition, the habitats for the populations of Annex 1 species of European importance, with particular reference to:

- intertidal mudflats
- saltmarsh
- shingle beaches
- shallow coastal waters
- grazing marsh.

To maintain, in favourable condition, the habitats for the populations of migratory bird species of European importance, with particular reference to:

- intertidal mudflats
- saltmarsh
- shingle beaches
- shallow coastal waters
- grazing marsh.

To maintain, in favourable condition, the habitats for the populations of waterfowl that contribute to the wintering waterfowl assemblage of European importance, with particular reference to:

- intertidal mudflats
- saltmarsh
- shingle beaches
- shallow coastal waters
- grazing marsh.

In respect of the first objective, two of the qualifying species named in the Natura 2000 Form for the SPA (see Appendix D1) are listed on Annex 1 of the Birds

[1] In each of these objectives, the term "maintenance"is intended to imply restoration if the feature is not currently in favourable condition. On the western boundary of the application site, Unit 49 of the SSSI is currently assessed as being in favourable condition. To the south and east of the application site, Unit 100 is in an unfavourable condition.

Directive: avocet and little tern. In respect of the second objective, the relevant species are as follows:

- dark-bellied brent goose
- common shelduck
- northern pintail
- ringed plover
- grey plover
- red knot
- dunlin
- common redshank.

It is in respect of the potential for impacts on these ornithological interests that that the planning authority may be required to undertake an "appropriate assessment" of the scheme under the Habitats Regulations.

3.5.1.2.4 Non-Statutory Designated Nature Conservation Sites

Review of the proposals map contained in Medway Council's Medway Local Plan 2003 and consultation with the Kent Wildlife Trust confirms that there are no non-statutory nature conservation designations (Local Wildlife Sites or Roadside Nature Reserves) within a 2 km radius of the application site.

There is an area within the ownership of E.ON UK, outside of the application site and to the west of the main access road into the existing power station, which is managed for the benefit of nature conservation by E.ON UK's site-based Environmental Initiatives Officer. This is commonly referred to as the "Nature Reserve". This area does not benefit from any formal non-statutory designation, but is a valued local nature conservation resource that includes a small Nature Study Centre and is used for visits by local school groups.

Habitats and Plants

A number of nationally rare and scarce plant species are known to persist on industrially developed sites such as Kingsnorth in this part of Kent, but none of the consultees held records of habitats or plant species within the application site, due to its inaccessibility to the public. The reports produced for the Kingsnorth "B" site in 1988 did not include surveys of land affected by the current development, so records of flora were limited to those gathered casually by E.ON UK staff subsequently. These included records of divided sedge *Carex divisa*, a nationally scarce species that is classified as being vulnerable to extinction in the wild (JNCC 2005).

Invertebrates

Information from the KMBRC included a list of species records from within 1 km of the site that included 11 species of invertebrate from the Kent Red Data Species Inventory. Most of these records were provided at 1 km resolution, i.e. using a four-figure grid reference, and labelled "Kingsnorth" without any indication whether they were gathered at the power station. Those that were provided with a six-figure grid reference are outside of the site, and appear to relate to the SSSI/SPA/Ramsar site. However, two species of Diptera ("true" or "two-winged" flies) were recorded from

points within the application site in 1987; the hoverfly *Paragus albifrons* and *Chrysotus veralli*. Both are listed in the national and Kent Red Data Books, and in neither case is the species' habitat requirements/preferences well-understood.

Amphibians

Information from the Environmental Initiatives Officer indicated that great crested newt *Triturus cristatus*, a European protected species[2], is known to have bred in freshwater habitats within the boundary of the existing power station at Kingsnorth. Kent and Medway Biological Records Centre Kent and Medway Biological Records Centre (KMBRC) provided records of the species from the site, dating from 1996 and 1997. Casual recent records of breeding great crested newts (GCNs) were provided for a pond within the Kingsnorth Nature Reserve and a nearby ornamental pond in the garden of the reserve's Nature Study Centre, as well as records of their presence (no evidence of breeding) in the large drain that lies along the northern boundary of the Kingsnorth power station site (B. Jones, *pers. comm*.).

A further pond, approximately 50 m outside of the Kingsnorth site but within the boundary of the adjacent Damhead Creek power station, was also reported to support breeding GCNs (B. Jones, *pers. comm*.) and information on the ScottishPower website for the Damhead Creek power station confirmed that parts of that site support the species. Further, unpublished, information was provided on behalf of ScottishPower by its ecological consultants, on condition that detailed information on the site is not published. These data confirmed the presence of five waterbodies within a 500 m radius of the proposed development site that were found to support great crested newts during surveys in 1999, of which three have been subject to monitoring for great crested newts over the period 2001 to 2005. One of these waterbodies, located within 60 m of the Kingsnorth Units 5 and 6 application site, is confirmed by these data as being a regular great crested breeding site, supporting a population that in 2005 would be in the "small" size class.

Reptiles

The Kingsnorth Nature Reserve is known to support good populations of three common reptile species, namely common lizard *Lacerta vivipara*, grass snake *Natrix natrix* and slow worm *anguis fragilis*, and these species were also reported to be present elsewhere across the site (B. Jones, *pers. comm*.), although no formal surveys had previously been carried out to assess their distribution.

Mammals

The West Kent Badger Group confirmed that there are records of badgers *Meles meles* at Kingsnorth Power Station and a badger sett was reported to be present within the boundary of the site (B. Jones, *pers. comm*.), but no formal surveys had previously been carried out to check for other setts or to assess levels of badger activity across the site.

The KMBRC confirmed records of water voles *Arvicola terrestris* from 1987 and 2000 at unidentified ditches within Kingsnorth power station, and the Environmental Initiatives Officer confirmed that water voles were present in the ditch that lies along the northern boundary of the power station (B. Jones, *pers. comm*.).

[2] European protected species are defined in Regulation 38 of the Habitats Regulations.

The KMBRC provided details of 114 bat records, including 73 roost and 5 hibernation sites, recorded over the period 1983 – 2002 within a 5 km radius of the application site. These records were of 6 species, the majority of which were common and soprano pipistrelles *Pipistrellus pipistrellus* and *P pygmaeus*. None of the records provided were of bat roosts or activity within or immediately adjacent to the application site.

The KMBRC also provided records from 2004 of harvest mouse *Micromys minutus*, a Kent Red Data Book species, from the Kingsnorth Nature Study Centre.

Birds

The Environmental Initiatives Officer is a licensed bird ringer and has monitored use of the Kingsnorth power station site by birds for more than 25 years, so is well placed to provide information on the avifauna of the site. Of particular note is that the existing power station structures are a traditional nesting site for two bird species that benefit from special protection through listing on Schedule 1 of the Wildlife and Countryside Act, as amended. Peregrine *Falco peregrinus* regularly nests on the main chimney, and a declining population of black redstart *Phoenicurus ochruros* nests in a variety of the power station structures, including operational buildings.

A further Schedule I bird species, avocet *Recurvirostra avosetta*, has nested within E.ON UK land holdings at Oakham Marsh, within the SSSI/SPA/Ramsar site, which is approximately 600 m from the application site at its closest point.

The most recent data available from the BTO's WeBS low tide counts (1996-7 and 2005-6) and core count data for the five years from 2000-01 to 2004-5, are provided in Tables 1 and 2 at Appendix D2. Maps 1and 2, also provided at Appendix D2, show the areas where these counts were made.

The Oakham/Downhead (Damhead Creek) areas represent only a small part of the whole of the Medway Estuary and Marshes SPA, and these WeBS data suggest that areas around Kingsnorth are generally comparable with average bird densities recorded across the rest of the Medway estuary for any species recorded (Table 1).

3.5.1.2.5 Existing Data on the River Medway

Information on the River Medway is provided in the Section 3.2.3 on Water Quality and Section 3.5.7 on Aquatic Ecology.

3.5.1.2.6 Field Survey Methodologies

Extended Phase 1 Habitat Survey

As part of the scoping stage for this Ecological Impact Assessment an Extended Phase I Habitat Survey, as described in "Guidelines for Baseline Ecological Assessment" (IEA 1995), was carried out at the Kingsnorth power station site on 2nd May and 21st June 2006. Phase I survey is a standardised method of recording habitat types and characteristic vegetation, as set out in the "Handbook for Phase I Habitat Survey – a technique for Environmental Audit" (JNCC 1993). This habitat survey method is "extended" through the additional recording of specific features indicating the presence, or likely presence, of protected species or other species of

nature conservation significance. Descriptive "target notes", are made for characteristic habitats, features of ecological interest, or any other features which require note to aid ecologically sensitive design or mitigation.

From consultation and the extended Phase 1 habitat survey, it was concluded that the following issues would warrant more detailed survey:

- amphibians, especially great crested newts (a European protected species);
- potential for bat roost sites in trees and structures (European protected species);
- water voles (partially protected species in Britain);
- badgers (badgers and their setts protected in Britain);
- breeding birds, in particular protected, SSSI/SPA/Ramsar-cited and BAP species;
- reptiles (partially protected species);
- wintering birds, in particular species listed in the SSSI/SPA and Ramsar citations;
- plant communities and higher plants (species of conservation interest).

Additionally, in view of records of harvest mouse, a watching brief for evidence of their nests was maintained during all other survey visits to potentially suitable habitats within the site. Information on the scope and timing of the specialist surveys listed above is provided.

3.5.1.3 Great Crested Newt Survey

A schedule of waterbodies within a 500 m radius of the application site was made, and a great crested newt survey was undertaken of all waterbodies to which permission to survey could be gained. The survey was undertaken in accordance with the methodology set out in the "Great crested newt mitigation guidelines" (English Nature 2001) and consisted of six site visits in suitable weather conditions between 18th May and 20th June 2006, with a range of survey methods used on each occasion. The methods employed included egg searches, habitat searches, bottle-trapping and torchlight surveys using 1,000,000 candlepower torches. The surveys were carried out under English Nature Licence Numbers 20061447 (F. Oliver), 20051991 (L. Swankie) and 20050526 (C. Mellor).

One ditch, running west to east along the southern boundary of the development area (see TN 20 on Figure 2), was excluded from the survey even though it represented potentially good aquatic habitat for amphibians. This was because it had been subject to accidental contamination with black oil, which formed a layer across the water's surface and on marginal vegetation at the water's edge along most of its length. The effects of this pollution can reasonably be expected to decrease with time, so for the purposes of this report, a precautionary approach to this limitation has been adopted, i.e. it will be assumed that, although great crested newts were not present on this ditch during 2006, it could be used by this species in the future.

The construction laydown area that is separate from the rest of the site (TN 27) includes a drainage ditch, which could not be surveyed for great crested newts or inspected closely due to lack of access permission. Similarly, other ponds shown on OS plans as being present on third party land within a 500 m radius of the site (see ponds P6 – P12), were not surveyed due to lack of access permission.

3.5.1.4 Bat Survey

The parts of the application site proposed for development or for use as temporary construction laydown areas were surveyed for their potential to support roosting bats by a licensed bat ecologist (Licence no. 20061107) on 20th and 21st June 2006. The first stage of the survey was a habitat-based assessment to determine the likelihood of roosts being present in trees and buildings with potential to be affected by the proposed development. A daytime interior and exterior search was made of a disused garage building on the site of the former Holm Lodge (TN 2), to search for any evidence of roosting bats. A nearby disused electricity sub-station building (TN 5) was also checked for signs of bats from the outside, as access to the interior could not be gained because the door was blocked.

Following the day-time search for bats, dusk and dawn bat surveys were undertaken on 20th/21st June 2006 to check for bats emerging from Holm Lodge garage. This involved the licensed bat consultant and another experienced bat surveyor, both with heterodyne bat detectors, watching the building from all angles from half an hour before sunset until one and a half hours after, and again from one hour before dawn until full daylight.

3.5.1.5 Water Vole Survey

A water vole survey to confirm presence/absence was undertaken in accordance with the guidance in the “Water vole conservation handbook” (Strachan and Moorhouse 2006). This survey was undertaken in tandem with the great crested newt survey visits, and involved searching the banks of waterbodies within and close to the application site for any signs of water voles, such as burrows, latrines, feeding stations, lawns, footprints and pathways.

In order to comply with E.ON UK health and safety requirements, the site’s northern boundary ditch (TN 14) was accessed for survey only from its southern side, making it easier to detect water vole burrows in the northern bank than in the southern bank, and to find latrines on the southern bank than on the northern bank. Steep sides and dense bankside vegetation along sections of this ditch also hampered detailed search along parts of its length. However, as no works to this ditch are proposed, detailed census of burrows or latrines was not required in this instance. Consequently, these limitations on the survey of the northern ditch are not considered to compromise the validity of the assessment provided in this report.

The ditch (TN 20) to the south of the development area could not be effectively surveyed for water voles or their burrows because of the presence of oil, but it was occasionally possible to see burrow entrances at the water line. For the purposes of this report, a precautionary approach to this limitation has been adopted, i.e. it will be assumed that, although water voles were not present on this ditch during 2006, the burrows may have been used by water voles in the past and may be re-occupied in the future.

The construction laydown area that is separate from the rest of the site (TN 27) includes a drainage ditch, which could not be surveyed for water voles or inspected closely due to lack of access permission.

3.5.1.6 Badger Survey

On 2nd May 2006 an experienced badger surveyor undertook a survey of the development area and construction laydown areas for badger setts and any other signs of badger activity, such as latrines, dung pits, pathways and foraging. Setts were subsequently checked for signs of activity on 21st June and during reptile surveys in October.

3.5.1.7 Breeding Bird Survey

A breeding bird survey was undertaken of the application site and surrounding land in the ownership of E.ON UK. A number of generic survey methods for breeding birds and single species methods for species of conservation concern have been developed and are accepted benchmarks for determining evidence of breeding or population size (Gilbert *et al.* 1998). A modification of this approach commonly carried out for ecological impact assessment is reduced survey effort for the generic survey of all species, when breeding evidence rather than population size is required (IEA 1995) and full single species surveys for targeted species of conservation concern. This approach was adopted at Kingsnorth.

The generic survey method was a walkover survey of the land holdings on three occasions in the appropriate season and time of day. All land was walked over and approached to within at least 100m, other than the saltmarsh and associated saline lagoons at Oakham Marshes, which were viewed from the saltmarsh edge. It was considered inappropriate and unnecessary to walk over the saltmarsh and lagoons, given the distance from the application site, that the purpose of the survey was not to estimate the number of territories and that part of the area was a SSSI, which could be disturbed by the surveys. The location and activity of all species was mapped and recorded with Common Bird Census codes (Marchant 1988). Birds were recorded as either breeding or present (the latter with the assumption of not breeding) according to the criteria of the British Trust for Ornithology's New Breeding Birds Atlas (Wingfield-Gibbons *et al.* 1994).

Target species were species afforded additional protection against disturbance at the nest through inclusion on Schedule I of the Wildlife and Countryside Act 1981 (as amended), UK BAP priority species given consideration through Section 74 of the Countryside and Rights of Way Act 2000, to be shortly superseded by Section 41 of the Natural Environment and Rural Communities Act 2006, and species on the Red List of birds of conservation concern in the UK (Gregory *et al.* 2002). Through detailed observations over a number of years by the Environmental Initiatives Officer working at the power station, the Schedule I target species could be scoped with certainty as:

- peregrine;
- black redstart; and
- avocet.

UK BAP species known or suspected to breed on the site (skylark, turtle dove, song thrush, linnet, bullfinch and reed bunting) and species not in this category, but included on the Conservation Concern "Red List" (starling and house sparrow) were adequately covered for breeding evidence, if not always population size (skylark) by the generic survey (Gilbert *et al.* 1998). In addition, nightingale was chosen as a target species due to the local interest in the Kingsnorth population, which was

identified as a social as well as biodiversity value according to IEEM guidance (IEEM 2006), the UK importance of the Kent population (KOS 2000) and therefore the the generic survey method was modified slightly to estimate the nightingale population.

Black redstart and nightingale surveys followed the standard methods of Morgan and Glue (1981) and Henderson (1996) respectively. The one lagoon on which avocet had previously bred could be adequately viewed during the generic survey. Peregrine breeding information was supplied by the Environmental Initiatives Officer, who rings the chicks at the nest in most years.

The evidence of breeding required under the BTO New Atlas methods is likely to over-estimate the number of species nesting in the study area, for example where birds are foraging from outside the area. The methods also take no account of breeding success. For most species, no population estimate has been made.

3.5.1.8 Wintering Birds Survey

A wintering birds survey has been commissioned, and commenced in September 2006. Findings will be reported in due course.

3.5.1.9 Reptile Survey

A reptile survey utilising artificial refugia was undertaken during warm autumn weather between 7th October and 3rd November 2006. The survey was undertaken in accordance with published guidance (Foster and Gent 1996, Froglife Advice Sheet 10), with tiles of roofing felt 700 x 700 mm and corrugated tin 500 x 500 mm deployed across the areas proposed either for development or for use as temporary construction laydown areas at a rate of approximately ten refuges per ha. The tiles were checked for the presence of reptiles on seven occasions (not consecutive days), at an appropriate time of day and during suitable weather conditions, over a period of three weeks.

3.5.1.10 NVC Survey

A botanical survey using National Vegetation Classification (NVC) methodology (Rodwell 2006) was carried out on grassland areas within the application site and on the adjacent saltmarsh and ditches, which were identified during the extended Phase I habitat survey to potentially support important NVC communities and/or species of nature conservation value and potentially fall within Section 74 of the CroW Act 2000 requirements to conserve priority habitats within the UK BAP. The grassland surveys were carried out on 9th June and 2nd July 2006; and the ditch and saltmarsh visits were carried out in the weeks commencing 14th August and on 29th September.

3.5.1.11 Data Limitations

Minor survey limitations relating to the collection of water vole data on the northern boundary ditch, and the implications of oil pollution on the ditch to the south of the application site, are described in the sections on great crested newt survey and water vole survey methods above. These limitations are considered to be minor, and additional survey of the site under current conditions would not materially alter the conclusions of this Ecological Impact Assessment, based on the layout of the development as currently proposed.

The temporary laydown area on land outside and to the north of Kingsnorth power station had to be surveyed from outside through binoculars, due to access

permission not being available. This is a limitation of significance in relation to this particular parcel of land, as there is a ditch present that could not be checked for protected species.

The lack of access to survey ponds on third party land at the neighbouring Damhead Creek power station is not considered to be significant, as great crested newt monitoring data made available by ScottishPower provided a sound baseline upon which to base the assessment of impacts to this species in that area (P8 – P12). The lack of survey data on great crested newts for the two large rectangular waterbodies to the west of the Nature Reserve (P6 and P7) is considered only to be a minor limitation, given the sub-optimal nature of these habitats and their proximity to the Nature Reserve and associated buffer zone.

3.5.2 Baseline Description

This section presents a description and evaluation of baseline conditions for the EcIA, based upon consultation and the results of the extended Phase I habitat and specialist surveys described above. Plant nomenclature follows Stace, 1997.

Criteria are applied to assess the nature conservation value of the habitats and species/populations that the site supports, which is based upon a combination of published sources, consultation responses, local knowledge and professional judgement. Further information is provided in the evaluation at Section 3.5.3 below. The categories of nature conservation value referred to in this section are as follows:

- International – sites, habitats and species of significance in a European/global context;
- National – sites, habitats and species of significance in the context of Great Britain/UK;
- Local – habitats and species of significance in the context of Kent/Medway;
- Low - sites, habitats and species of significance within the zone of influence only;
- Negligible or no nature conservation value.

3.5.2.1 Habitats and Plant Communities

The Phase 1 habitat map of the Kingsnorth power station site is presented as Figure 3.5.2, with target note site descriptions at Appendix D3. The following habitats are present within the application site (listed in decreasing order of extent):

- Buildings/structures, roads, car parks, coal stockyard and other areas of hardstanding;
- Amenity grassland – regularly mown with ornamental tree and shrub planting;
- Improved grassland – both unmown and managed for hay;
- Semi-improved neutral grassland;
- Broadleaved plantation and semi-natural woodland;
- Ephemeral/short perennial communities;
- Dense and scattered scrub;

- Standing water – lagoons, ponds and ditches;
- Spoil (pulverised fuel ash);
- Marginal swamp;
- Stands of tall ruderals.
- Running water (Medway Estuary beneath Longreach Jetty only); and
- Intertidal mud/sand (Medway Estuary beneath Longreach Jetty only).

Buildings, Structures, Roads and Areas of Hardstanding

The current operational part of the power station site is covered by roads, hardstanding, the coal stockyard and the power station buildings/structures. A number of the buildings include small fenced enclosures that contain electrical infrastructure on concrete that is topped with a shallow layer of coarse aggregate that supports minimal vegetation. These built-up habitats in the operational part of the site provide breeding sites that are used by peregrine and have in previous years been used by black redstart, but are otherwise considered to be of negligible intrinsic ecological value.

There is one area of man-made surfaces that was used for construction workers' accommodation when the power station was built in the 1970s (see TN 6 in Figure 3.5.2). Roads and paths, and hardstandings where portacabins were once located, now remain as minimally vegetated patches amongst unmanaged tall ruderal and scrub/ornamental shrubs. These areas represent good habitat for invertebrates, providing sheltered conditions with a mixture of bare ground for basking and plants that are good nectar sources. It also appears to provide ideal habitat for reptiles, with dense scrubby areas for cover and more open areas for basking.

Flora

Amenity Grassland and Ornamental Tree and Shrub Planting

Surrounding the buildings and roads in the operational part of the site are areas of mown grassland, together with small areas of ornamental tree and shrub planting. These lawns vary in botanical character, but most are of low diversity and all comprise common species characteristic of circumneutral soils. Under current management, maintained as short swards through regular mowing, these amenity grassland habitats with ornamental tree plantings, are assessed as being of negligible nature conservation value.

Improved Grassland

Improved grassland of no botanical value is the dominant habitat of the fields at the centre of the development area. These agriculturally improved fields are mown annually for hay and are of negligible intrinsic ecological interest, although these habitats are used by amphibians, reptiles and mammals including badgers for foraging, and provide refuge for some of these species during periods when the grass is tall enough to provide cover.

Semi-Improved Grasslands

The most substantial areas of semi-improved grassland within the application site are the fields to the west and east of the improved fields described above. These were subject to an NVC survey due to their listing on the Inventory of Grazing Marsh and the possibility of their being relict floodplain grassland. The community determination was **MG1** *Arrhenatherum elatius* grassland, which is a dominant type of fields that are cut periodically, but not mown, and derive from recently sown or neglected land on neutral soils. This conforms with the land-use history of these fields.

There are also areas of semi-improved neutral grassland around the boundaries of the site and along the flood defence bunds of the drainage ditches. These areas are characterised by rank, but not tussocky, **MG1** grasslands with stands of tall ruderals that appear to be mown infrequently, as evidenced by the presence of light bramble *Rubus fruticosus agg* scrub and occasional saplings.

The above areas of tall and rather species-poor semi-improved neutral grassland offer a degree of diversity, in terms of both species and structure, and provide suitable foraging habitat and shelter for a range of invertebrates, amphibians, reptiles, birds and mammals. These grasslands are, however, not uncommon locally and appear unremarkable by comparison with similar habitats outside of the application site, and are therefore assessed as being of low ecological value.

There is an area of species rich neutral grassland (TN4) enclosed by trees and scrub, south of Holm Lodge Wood. The relatively sheltered microclimate in this glade, combined with intimate mixture of short and tall swards with bare ground and scrub, make it particularly good habitat for invertebrates, which were abundant throughout, with a notable diversity of butterflies, moths, grasshoppers, flies and bees. This area of semi-improved neutral grassland is also assessed as being of low ecological value, principally due to its very small size.

Broadleaved Plantation and Semi-Natural Woodland

Semi-natural woodland within the application site is limited to the young birch-dominated self-sown woodland in the former garden of Holm Lodge (TN 1), which has a sparse understory of hawthorn and elder, supplemented in places by unmanaged garden shrubs. The ground flora varies depending upon moisture status and light levels, but is generally either grassy or bramble-dominated around the edges, with more bare ground internally. Some damp ground is present, with broad-buckler and male ferns, soft rush, creeping bent and small colonies of marsh orchid *Dactylorhiza* species. A single specimen of broad-leaved helleborine was recorded at Holm Lodge Wood, with further specimens present in woodland in the Nature Reserve woodland on the opposite side of the access road, i.e. outside of the application site.

The remaining woodland within the application site is mature broadleaved plantation, comprised mainly of birch, hornbeam, willows and white poplar, which is quite dense with limited understory of hawthorn and elder. Ground flora is also limited, being typically found around the edge and where there are gaps in the canopy and light levels are slightly higher.

Of no botanical interest, and small in size, these unremarkable wooded habitats have been assessed as being of low value, principally because they offer a diversity of habitat structure and opportunities for shelter and foraging to a range of invertebrates, amphibians, reptiles, birds and mammals.

Ephemeral/Short Perennial Communities and Bare Ground

There are a number of areas throughout the operational parts of the site that contain bare ground with some ephemeral/short perennial vegetation. These areas include those around the large tanks in the south-east of the operational site and pulverised fuel ash (PFA) between the coal stockyard and the saltmarsh and some small patches in the north west of the site. Elsewhere, a number of the buildings include small fenced enclosures that contain electrical infrastructure on concrete that is topped with a shallow layer of coarse aggregate that supports little vegetation. These habitats in the operational part of the site may represent part of the foraging habitat used by black redstart, when this species has bred on the site, but are otherwise considered to be of negligible intrinsic ecological value.

Standing Water

The most extensive areas of standing water in the application site are found at the complex of lagoons shown as TN 25 in Figure 3.5.2. These lagoons, which are fringed with reedswamp in places, are in an operational part of the site where pulverised fuel ash is tipped. It is understood that lagoon cockles are present at many of these waterbodies, indicating that they hold saline/brackish water. Saline lagoons are a UK BAP priority habitat, and are associated with a number of plants and invertebrate species of nature conservation significance. The area is excluded from the adjacent SSSI/SPA/Ramsar site designation, suggesting that the statutory agency has in the past assessed it as failing to meet the published criteria for evaluation as part of the internationally/nationally important sites. In view of the health and safety risks and the fact that no operations are proposed in this part of the site, it was felt that they would not need to be subject to detailed survey, other than for breeding and wintering birds, to establish the extent to which they may be used by wildfowl wintering at the adjacent SPA/Ramsar site. The nature and extent of this area, and its location adjacent to the Medway Estuary and Marshes European site, means that it has some potential to be of local nature conservation significance.

There are several large drains, between 1 – 3 m wide within the application site (see TNs 14, 20 and 22). All are contained between steep banks clothed in rank grassland with ruderals and some bramble scrub, and all contain stands of common reed and other swamp species, with varying amounts of open water. The water in the drains is controlled by sluices, and when surveyed in 2006 there was no perceptible flow in any of them. The plant communities present indicate that the water in these drains may be brackish. With the exception of TN 20, which was affected by oil in 2006, the other permanently wet drains all support a range of aquatic invertebrates and macrophytes. These drains represent good habitat for invertebrates, amphibians, reptiles and small mammals, but appear unremarkable in the context of the local area, and are therefore assigned a low ecological value for the purposes of this assessment.

There are three ponds located within the application site. Two (TNs 17 and 18) are located in the semi-improved neutral grassland field to the east of the development area. Both of these are relatively shallow scrapes in the underlying clay that were dug in 2004 (B. Jones, *pers. comm.*) and are being allowed to vegetate through natural ecological succession. As a result, neither has significant aquatic or marginal vegetation at present. The more northerly pond (TN 17) has cloudy water, whereas that in the other (TN 18) is clear. These ponds are assessed as being of low ecological value.

The third pond in the application site is a small ornamental pond set within a quadrangle amongst the existing office accommodation on the site (TN 21). The pond is tiled, with sheer 90º sides and is surrounded by concrete, mown amenity grassland and planted trees and exotic shrubs. There is a small amount of aquatic vegetation and numerous large fish. This pond is considered to be of no value in ecological terms.

The only other aquatic habitat within the application site is a ditch that lies mainly within the Nature Reserve, i.e. outwith the application site, but which does encroach to a limited extent into the application site. It is overgrown, with dense scrub along the banks and the water is choked in places with vegetation. It was observed that the water level in this ditch can vary rapidly. This ditch contributes to the local interest of the Nature Reserve, but in isolation would be considered to be a feature of low nature conservation value.

There are a further two ponds outside the application site within the Nature Reserve, which lies to the north-west of the application site. One of these ponds (P4 in Figure 3.5.3) is large and is divided into two distinct portions by a bridge. Much of the eastern half is covered by dense bulrush *Typha latifolia*, while the western half is mostly open water, although there is a dense layer of the invasive non-native New Zealand pygmyweed *Crassula helmsii* around the edges. The other pond (P5 in Figure 3.5.3) is a small formal ornamental pond in the garden of the Nature Study Centre. This pond is set within a mown lawn and contains some aquatic vegetation.

To the west of the Nature Reserve, on third party land, OS maps show two large square ponds (P6 and P7 in Figure 3.5.3). There was no permission to access these ponds, and consequently they have not been surveyed or evaluated for this assessment. Another pond shown on the OS plan of the industrial estate to the north of Holm Lodge Wood, was visited in 2006 and found to be a small ornamental pond that had been emptied and the liner punctured. It is of no ecological value.

To the north of the application site, on land owned by ScottishPower as part of its Damhead Creek power station, OS maps indicated an indeterminate number of waterbodies, of which ScottishPower's consultants provided limited information on five that lie within 500 m of the application site and have been recorded in the past as supporting great crested newts. None of these waterbodies could be viewed from Kingsnorth power station. This area is understood to be being managed for nature conservation generally, and for great crested newts and rare plant species in particular, so it has been assessed as being of local nature conservation value for the purposes of this assessment.

Swamp and Aquatic Vegetation

The northern ditch (TN 14) was included within the NVC survey. There is fairly continuous fringe of swamp vegetation, of which the brackish water community **S21** *Scirpus maritimus* swamp is dominant, with smaller areas of **S4** *Phragmites australis* swamp, **S12** *Typha latifolia* swamp and **S18** *Carex otrubae* swamp. The dominant aquatic community is the **A12** *Potamogeton pectinatus* community, but there also sections with the **A6** *Ceratophylum submersum* community, and to the east the **A21** *Ranunculus baudotii* community, which also occurs in the northern of the two field ponds, and the **SM2** *Ruppia maritima* saltmarsh community. In the presumably more saline water to the east sea rush *Juncus maritimus* is also locally dominant on the ditch banks.

A patch of **S21** *Scirpus maritimus* swamp occurs in the west of the proposed development area. Specimens of the nationally scare divided sedge *Carex divisa* were also recorded in this area.

Tall Ruderals and Scrub

Stands of a range of tall ruderal species, including common nettle, cow parsley and hemlock, occur throughout the application site, most often in unmanaged or infrequently managed areas where they may be associated with scrub dominated either by bramble or by species including hawthorn, dog rose or willows. These habitats are common and widespread throughout the site and the wider landscape, and are of negligible intrinsic interest, although they do provide habitat for species of interest – particularly the nightingale population centred in/around the Nature Reserve.

River Medway and Intertidal Mud and Sand

The intertidal habitats at the cooling water intake and at the Longreach Jetty have been modified by the operations of the power station, with the area around the intake structures (TN 23) dredged to maintain open water, and the area at TN 24 affected by the presence of the Longreach Jetty and roll on- roll off (RoRo) ramp. These areas are surrounded by intertidal deposits of varying particle size, which do not appear from visual inspection to be significantly different from other parts of the estuary locally.

Fauna

Great Crested Newts

A total of eight waterbodies in the ownership of E.ON UK plc were surveyed for great crested newts during spring 2006. Their locations are shown on Figures 3.5.2 and 3.5.3 and a description of each is provided at Appendix D3. The results of the great crested newt surveys are provided in the Table at Appendix D4.

Single adult great crested newts were recorded in three of the waterbodies within the application site, the northern ditch (TN 14) and the two ponds within the semi-improved grassland at the eastern end of the application site (TNs 17 and 18).

In summary, within the application site, one male was caught in a bottle trap on a single occasion on the northern ditch (TN 14, shown as D1 in Figure 3.5.3); one female recorded during a torch survey on a single occasion at TN 17 (P1 in Figure 3.5.3) and one male caught on four occasions in a bottle trap at TN 18 (P3 in Figure 3.5.3). Despite the presence of adult newts, there was no evidence of breeding at any of these waterbodies, all of which contain water that is brackish.

Outside of the application site, great crested newt larvae were recorded in the ornamental garden pond on the Nature Reserve (see P5 in Figure 3.5.3), with up to 9 great crested newt larvae caught at this pond on three occasions. Although not of a kind usually considered “optimal” habitat for great crested newts, this pond has no contact with ground water, and it is possible that the fact that it is freshwater rather than brackish may be a factor in its success as a breeding site for the species.

The statutory agency for nature conservation has produced guidance (English Nature 2001) on great crested newt population size class assessment, which uses as its basis a maximum adult count per pond per night. In some instances, this can be

cumulative for the site as a whole where there is definite interchange of animals between ponds. However, the counts must all be undertaken on the same night. Survey results can then be expressed as peak counts per pond and a total site count, if appropriate.

Populations can then be classed as:

- "small" for maximum counts up to 10;
- "medium" for maximum counts between 11 and 100; or
- "large" for maximum counts over 100.

A maximum count of one was obtained on the northern drain D1 from bottle-trapping on 18/19th May 2006; and a maximum count of one on pond P2 during a torch survey on 18th May 2006. Using the above method, this then gives a "small" population size for both ponds and the application site as a whole. Furthermore, 2001 – 2005 monitoring data on great crested newt populations at Damhead Creek power station (PAA 2005) suggests that, even if ponds within 500 m of the Kingsnorth application site are taken into account, the population size class of great crested newts centred on the regular breeding pond at the Damhead Creek Pumping Station pond (P8 in Figure 3) and extending into the Kingsnorth site is still likely to fall into this "small" category.

Smooth newts were recorded in seven of the eight waterbodies surveyed. The only waterbody not supporting smooth newts was the reservoir at the end of ditch D3. Other species also recorded during the surveys, included 3-spined and 10-spined stickleback, damselfly larvae, diving beetles, shrimps and marsh frog tadpoles.

Water Voles

In total, nine latrines, 15 burrows and four grazed lawns were recorded along the northern drain (TN 14). The greatest area of activity was approximately 60-80 m from the eastern boundary of the site, although this could reflect ease of access and therefore recording, rather than increased activity. Mammal burrows were present at the waterline of the oil-affected drain at TN 20, but no signs of activity were present. For the purposes of this assessment, it is assumed that water voles will recolonise this drain in future, as the water quality recovers.

Bats

The walkover bat survey identified the disused garage (TN 2) at the former Holm Lodge as having the potential to support roosting bats. The building is a small brick structure with concrete rendering and waney boards above the doorway. The wooden roof is partly demolished but the beams are still in place. The garage is surrounded by broadleaved woodland and is covered in a dense covering of ivy, which has potential to support roosting bats.

No bats were recorded entering or leaving the building during the dusk and dawn survey, nor was any bat activity recorded in the area at all, despite the weather conditions being perfect for surveying and the quality of the habitat good for bat foraging.

Despite many trees being present on site, including some large mature specimens, based on visual inspection from the ground, none were found to contain features that

may be used by roosting bats. The majority of the woodland on site is of small size/young age, meaning that holes and cracks are likely to be uncommon.

One small building was found to remain in an area that is to be used for construction laydown. This building, an old electrical building (TN 5), comprises a 2 x 3 m brick and mortar structure, with a flat concrete and roofing felt roof. Missing air vents could provide access to bats, although there were no external signs of this, but the entrance to the building was blocked and internal investigation not possible. Given the small size and simplicity of the building, and on the basis that internal access would be possible prior to demolition, a dusk/dawn survey was not considered necessary in this instance.

A single Daubenton's bat was incidentally recorded foraging along the length of the northern drain by the great crested newt surveyors during the visit on 5th/6th June.

Badger

There are two badger setts present within the application site, both within TN 3. One had two active entrances visible but with potential for further entrances in impenetrable scrub on the other side of the fence; and the other had a single entrance. Both setts have shown signs of occupation by badger throughout the period March – September 2006, although signs of activity around the setts and elsewhere within the application site are not suggestive of high levels of activity.

The entrance to the single-hole sett has been damaged/interfered with. In situations such as this, where badgers live in close proximity to human activity and suffer from persecution, their behaviour may not conform to the “traditional” social structure/sett hierarchy based around the use of a main breeding sett. Instead, they will often live in ones and twos and use even small setts as breeding sites. This means that the possibility of the setts, especially the larger and obviously long-established one with two visible entrances, being used as a breeding sett cannot be ruled out entirely.

Reptiles

The reptile survey confirmed that the areas proposed for the development and associated construction/laydown activities support reptiles. The results of the survey are provided at Appendix D5. Three reptile species were present; common lizard, slow worm and grass snake.

The greatest numbers of common lizard and slow worm, and the only specimen of grass snake, were recorded in the mixed habitats at TN 8, which is unsurprising as the habitats there are optimal and it is close to the Nature Reserve where habitats are managed to encourage these species. Other areas where common lizard and slow worm were found are the unmanaged mixed habitats at TN 4 and TN6. The base of the bund between TN 9 and TN 10 yielded a single record each for common lizard and slow worm. The grasslands where the development is proposed appear to have a patchy distribution of reptiles, with common lizard and slow worm both recorded mainly in areas of greatest cover, e.g. where vegetation is thicker along edges and fencelines.

Breeding Birds

The findings of the breeding bird survey are summarised in Appendix D6. The grassland in the development and construction laydown area to the north of the existing power station has a small population of meadow pipits. Species of local

interest associated with short lengths of scrub (TN 14) are linnet and reed bunting, and the temporary construction areas to the north (TN 3 and TN 8) had territories of nightingale, turtle dove, song thrush and bullfinch.

Change in species and population sizes

A survey of the breeding birds of the present study area and a wider area of farmland and saltmarsh was undertaken in 1988, as part of the pre-application studies for the development of Kingsnorth "B" (Roberts 1988).

Proven breeding species in the 2006 study and not in 1988 were greater Canada goose, greylag goose, shelduck, peregrine falcon, eurasian sparrowhawk, long-tailed tit, chiffchaff, blackcap and nightingale.

In the same period yellowhammer and yellow wagtail have been lost as a breeding species. In 1988 single pairs of redshank, lapwing and skylark held territories in the fields to the north of the power station within the application site (TN 16). These species are now lost from this area.

The main habitat changes of relevance to the ornithological interest of the application site are the development of dense scrub and secondary woodland at the Nature Reserve and Holm Lodge Wood (TN 1), which has resulted in colonisation by nightingales and a number of species of lesser conservation concern, and the cessation of grazing on the fields north of the power station, now periodically cut for hay, which will have contributed to the local loss of redshank, lapwing and skylark. Colonisation of the power station tower by peregrine falcon follows a national expansion of the population. The reasons for the loss of breeding black redstarts and whether this is permanent are unclear.

3.5.3 Evaluation

Following the adopted Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM 2006), ecological value is defined for a number of nested levels of interest, from International downwards, and is separated from legal protection to particular species. The value of the site or a part of it for a population of a given level of interest or for a legally protected species is defined by the features of the site that maintain the population at the level considered to give it favourable conservation status. For example, if a nationally important site for a bird species overlaps with the study site and five percent of the nationally important population breeds within this overlap, the site is of national importance for this feature and its national value is the habitats and human activity that sustain that five percent.

The following criteria are used in this evaluation:

- A feature is of **International** value if it is: (i) part of the qualifying population of a bird species for which a SPA has or could be designated; part of the qualifying population of species for which a Ramsar site has or could be designated; or (ii) is part of the habitat on which such a population is considered, from the best available evidence, to depend.
- A feature is of **National** value if it is: (i) part of the qualifying population of a species for which a SSSI has or could be designated under guidance on the selection of such sites (JNCC 1989); or (ii) is part of the habitat on which such a population is considered, from the best available evidence, to depend.

- A feature is of **Local** value if it is: (i) a habitat or species included in the UKBAP priority list, the Kent BAP HAP or SAP list, the Kent Red Data Book, the CRoW s.74 list, the UK Birds of Conservation Concern Red List (RSPB 2002) or plants listed as vulnerable in the Vascular Plant Red List for Great Britain (Cheffings and Farrell 2005); or (ii) is part of the habitat on which such a population is considered, from the best available evidence, to depend.

3.5.3.1 Features of International Value

The saltmarsh and inter-tidal mudflats down to the mean low water mark of E.ON UK plc's land holdings at Kingsnorth are within the Medway Estuary and Marshes SPA/Ramsar site. The SPA qualifies under Article 4.1 of the Birds Directive for breeding populations of avocet, common tern and little tern, in addition to its passage and wintering waterbird interest. The conservation objective of the European site refers to the two of these that are listed on Annex 1 of the Birds Directive, i.e. avocet and little tern. Neither species was recorded during the breeding bird survey.

The SPA's little tern breeding colony is approximately 2.5km to the east of the application site and birds are unlikely to forage within application site. There is not a pre- or post-breeding roost in the application site, so any use will be confined to feeding offshore or along the saltmarsh creeks when submerged and the saline lagoons, as feeding is by plunge diving for prey, predominantly small marine crustaceans, in saline waters.

Avocet has previously bred on the saline lagoons created by E.ON UK at Oakham Marsh. This area, 600 m from the application site at its nearest point, is the only potential breeding habitat in the vicinity.

3.5.3.2 Features of National Value

The Medway Estuary and Marshes SSSI citation notes that the SSSI is "of importance for its breeding birds". The SSSI would qualify as such for its breeding bird assemblage of sand-dunes and saltmarshes (JNCC 1989). The component species of the assemblage that bred in 2006 on the E.ON UK land holdings within the SSSI are as follows:

- Common shelduck
- Oystercatcher
- Ringed plover
- Lapwing
- Redshank
- Cuckoo
- Linnet
- Reed bunting.

In addition, component species of the assemblage that used the E.ON UK land holdings in 2006 were common tern and black-headed gull.

Of the above species, the application site was used by cuckoo, linnet and reed bunting, each of which potentially had territories overlapping the application site and the SSSI. The three species on which female cuckoos are most commonly parasitic,

reed warbler, hedge accentor and meadow pipit, hold territories within the application site. Linnet is a semi-colonial species and forages over the application site.

There are two to three reed bunting territories on the application site, but these are assessed as being separate from the SSSI population.

3.5.3.3 Features of Local Value

As the reed bunting territories within the application site are assessed as being separate from the SSSI interest for this species, for the purposes of this assessment, reed bunting is considered to be a feature of local value. Additionally, the following UKBAP priority/Kent Red Data Book bird species bred in or close to the application area in 2006:

- Turtle dove (application site and Nature Reserve)
- Skylark (outside the application site)
- Song thrush (application site and Nature Reserve)
- House sparrow (operational buildings in application site)
- Bullfinch (application site and Nature Reserve).

The population of breeding nightingale at the Kingsnorth power station qualifies as a feature of local value due the density of breeding pairs present and its inclusion on the Kent Red Data list. There were eight nightingale territories in 2006; two in the Nature Reserve and six in the application site.

Pochard and reed warbler are also included in the Kent Red Data Book, due to the high proportion of the UK breeding population of these species found in the county. Pochard was found only on Oakham Marsh in 2006, though it has previously bred on the northern drain in the application site (Bill Jones *pers. comm.*). Reed warbler is common both in the application site and wider area where common reed *Phragmites australis* occurs.

Other species that represent features of local value are as follows:

- The great crested newt populations that breed at Damhead Creek Pumping Station pond and Kingsnorth Nature Reserve, which range over terrestrial habitats in the application site.
- The water vole population on the northern drain, within the application site.
- The divided sedge *Carex divisa* in the application site.

The Kingsnorth Nature Reserve and Nature Study Centre represent a feature of local value, both in terms of the quality of the nature conservation resource that it contains, and from a social point of view because of the value of the site as an educational resource.

3.5.3.4 Protected Species

A pair of **peregrine** nested on their traditional site on the power station chimney within the application site and fledged two young in 2006. Birds were observed in direct flight over the application site, but not foraging.

Kingsnorth power station is a traditional nesting site for **black redstart**. The number of pairs has been declining and none were observed during the survey or in the 2006 breeding season by the Environmental Initiatives Officer, a licensed bird ringer who regularly monitors the site and rings the young (B Jones *pers. comm.*).

A foraging **barn owl** was recorded over the application site on one of the evening great crested newt surveys. No nesting activity was recorded in the application site and the nearest nest site is not known (B Jones *pers.com.*).

Great crested newts use habitats within the application site, although no evidence to confirm breeding was recorded. There are two known breeding ponds, both approximately 60 m outside of the application site boundary.

Water voles are present on the northern drain, within the application site.

There are two **badger** setts within the application site.
There are **grass snake**, **slow worms** and **common lizards** present in the application site. These common species of reptile are protected from intentional killing or injuring, which is implemented in a manner that requires developers to take reasonable measures to avoid harm.

A range of **breeding bird species** use the site. These birds, their nests and eggs, are protected from deliberate damage whilst breeding.

3.5.3.5 Summary

Table 3.5.1 provides a summary of the features of the application site that are considered to be of nature conservation value, both at the level of the site and in a wider context.

Table 3.5.1 : Features of Ecological Value to be Assessed at the site

Feature of Interest with Potential to be Affected	Value
Within the Application Site	
Use by qualifying species of the Medway Estuary and Marshes SPA	International
Use by qualifying species of the Medway Estuary and Marshes Ramsar site	International
Use by qualifying species of the Medway Estuary and Marshes SSSI	National
Use for breeding by eight bird species of local value	Local
Use of site by great crested newts (European protected species)	Local
Use of site by water vole (partially protected species)	Local
Presence of divided sedge	Local
Presence of badger setts (protected species)	Low
Presence of reptiles (partially protected species)	Low

Feature of Interest with Potential to be Affected	Value
Presence of common breeding birds (protection whilst breeding)	Low
Presence of other habitats	Low
Adjacent to the Application Site	
Medway Estuary and Marshes SPA – qualifying species	International
Medway Estuary and Marshes Ramsar site – qualifying interest	International
Medway Estuary and Marshes SSSI – qualifying interest	National
Kingsnorth Nature Reserve and Nature Study Centre	Local

These are the features upon which the ecological impact assessment for the development of Units 5 and 6 at Kingsnorth power station will be focussed.

3.5.4 Ecological Impact Assessment

This section considers the potential impact from construction and operation of two new units at Kingsnorth power station. Some of the measures already taken during the iterative design process to avoid or minimise adverse effects are also referred to here, but the main mitigation, compensation and enhancement proposals are set out in Section 3.5.5 below.

The new units will be built to modern standards with higher efficiency than the existing plant and will be fitted with flue gas desulphurisation (FGD) and selective catalytic reduction (SCR) systems to reduce emissions. Kingsnorth burns low sulphur coals and through-life will release many hundreds of thousands of tonnes less sulphur dioxide than most competitor plants, but the FGD plant is proposed to further substantially reduce sulphur dioxide releases. The new units will therefore have lower environmental impacts per unit of electricity produced than does the existing plant. As such, the development can be viewed as a positive substantial investment in increasing the protection of the environment by comparison with existing conditions.

However, local impacts from the development must also be considered. The site is adjacent to the Medway Estuary that is designated as an SPA and Ramsar site, i.e. is considered a European site for these two designations under the Habitats Regulations. Also, as with the existing power station, construction and operations will require use of the Long Reach jetty that does extend into the European site. It is therefore particularly important to consider possible impacts on these bird populations from noise and disturbance and demonstrate that there will be no risk to the integrity of the European site.

The significance of an impact is a matter of professional judgement, but can be described in general terms as being a product of the ecological or nature conservation value of a site/habitat/community/species (the “receptor”), and the magnitude of the predicted impact. As a general rule, the more ecologically valuable a site and the greater the magnitude of the impact, the higher the significance of that impact is likely to be. However, impacts are considered at different geographical

scales, and something that is not considered significant at one scale may be of significance when viewed in a different geographical context.

For instance, an adverse impact affecting the conservation status of a species for which a European site is designated would be considered to be of significance at an international scale, whereas a similar impact within the same site on a non-qualifying feature would not be of significance at the international scale, but might instead be significant in a national or local context.

3.5.4.1 Qualifying Interests of the Medway Estuary and Marshes SPA

Avocet has previously bred on the saline lagoons created by E.ON UK at Oakham Marsh, which is the only potential breeding habitat in the vicinity. This breeding site is approximately 1 km from the application site at its nearest point, approximately 2 km from the nearest element of built development, and is screened from works to the Longreach jetty by scrub and other tall vegetation on intervening habitats at Oakham Marshes.

The SPA's little tern breeding colony is approximately 2.5km to the east of the application site and birds are unlikely to forage within parts of the application site directly affected by the development. There is not a pre- or post-breeding roost in the application site, so any use will be confined to feeding offshore or along the saltmarsh creeks when submerged and the saline lagoons, as feeding is by plunge diving for prey, predominantly small marine crustaceans, in saline waters.

Consultation with the Environmental Initiatives Officer, who has in the past been one of the BTO's WeBS voluntary recorders, indicates that the fields proposed for development of Kingsnorth Units 5 and 6 and associated construction laydown are not subject to regular or frequent use by wintering birds for which the SPA is designated or which are listed in the conservation objectives of the European site. As the development will be constructed to the north of the existing plant, construction and operational works will largely be screened from the estuary.

Use by birds of the mudflats in the vicinity of the Longreach Jetty is likely to be adjusted to current levels of industrial activity at this location During the operational stage, coal will continue to be imported via the Long Reach jetty and it is proposed that this jetty could also be used for import of limestone and export of gypsum using self-unloading ships and barges.

The import and export of materials by river is in line with the Government's 'river first' policies and would require approximately 2 - 4 additional barge movements per month for the limestone and gypsum together. This additional light traffic would be balanced by fewer coal deliveries due to the smaller total capacity of the new units compared with the existing ones, and their higher efficiency, resulting in reduced coal consumption. Consequently, total shipping movements during the operation of units 5 and 6 will be comparable to existing shipping traffic and therefore **no impact** to qualifying interests of the SPA or the conservation objectives of the European site is predicted from this source during operation of the new facility.

During construction some large items of plant will be delivered by barge/ship and it is intended to use the existing 'Ro-Ro' spur on the Longreach jetty for movements of large loads, which effectively represents normal operation for this facility. The construction of additional conveyors and hoppers will be required for limestone and gypsum handling. This may require some re-arrangement of existing equipment on the jetty but the details will not be available until the design is carried out. A limited

amount of refurbishment to this structure may also be undertaken at this stage. This element of construction has potential for bird disturbance in the estuary. However, these would be temporary impacts, and the spatial scale of the works would be small in both absolute terms and relative to the size of the SPA/European site as a whole.

A discussion of disturbance impacts is set out below. These principles apply to bird disturbance at the the level of the SPA/Ramsar site (i.e. the European site) and the SSSI.

Human induced disturbance can have a significant negative effect on breeding success of birds and outside the breeding season may cause energy losses through interfering with feeding. For example public and vehicular access to open landscapes has been shown negatively to affect grazing geese in winter (Hockin *et al* 1992). The evidence suggests that disturbance is most severe from visible movement of people, rather than noise or equipment. For example, Murton (1971) (cited by Hockin *et al* 1992), reviewed the effect of airport scaring devices and concluded that birds become habituated to them and that similar habituation occurs in relation to traffic noise and aircraft engines. Reference is made to an experiment in which automatic bird scarers that produce loud explosions were only effective for one week, after which birds were even observed perching on the scarers. However, noise information is also considered further below as this does provide some quantifiable measure of changes to industrial impact in the area of relevance to bird disturbance.

It is a recognised problem for assessing impacts of disturbance to birds that there is inadequate research on the topic (Hill *et a*l 1997). This results in a lack of robust and scientific basis for impact assessment. Thus there are no environmental standards that can be applied in an analogous manner to air and water quality standards or for noise perception impacts on humans. However, English Nature has collated information relating to escape flight distances for waterfowl in response to disturbance (English Nature Birds Network Information Note) and relevant information from this Information Note, relating to species recorded from the WeBS data for this area, is shown in Table 4 at Appendix D7.

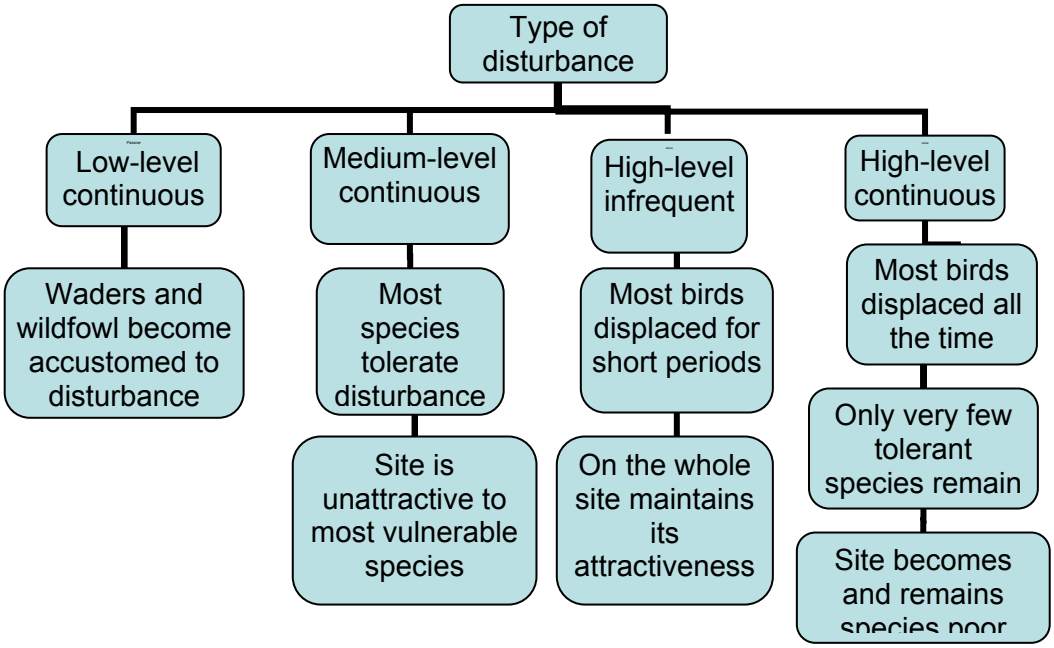
There are a range of responses depending on species involved, but also depending on levels of disturbance to which the birds have become habituated. Generally birds are more prone to taking flight during the hunting season, with the maximum distance (725m) for a reaction being observed for mallard in response to gun shots. Hunting is not a factor of relevance to the Kingsnorth site.

Other escape flight distances recorded are in the range 50 to 500 m with the majority of examples being below 300 m. To help to put this into context, a 300 m buffer zone around the area to be impacted by the development of Kingsnorth Units 5 and 6 is shown on Maps 1 and 2 at Appendix D2. These show the that the area potentially affected would be the Kingsnorth site itself; small parts of WeBS Low Tide Count survey areas 24, 26 and 29, and below low water mark of area 33; and Core Count areas 22467, 22761 and 22953 plus an area of 22952 that is below low water mark. It should be noted, however, that this zone is not adjusted in anyway to take account of screening provided by existing buildings and sea defence walls, and the impact area shown on the Maps 1 and 2 should therefore be taken to be very much an overestimate of a potential zone of some disturbance for bird populations. It does not signify a predicted area of loss of bird habitat.

It is worth considering the types of disturbance that would result from construction and operation of the ash handling and storage plant at Kingsnorth in relation to types

of disturbance as categorised by Hockin *et al* 1992. They proposed the categorisation shown in the diagram below.

Categorisation of Disturbance for Bird Populations



For example:	Gravel pit in progress	Fishing	Power boating
Pumping station	Humans screened in vehicles	Avocet/gulls returning to nest after disturbance by researcher	Shooting
Industry with no visible human presence			Walking humans
			Industry with high exposure by people

Disturbance arising from the operation of the new units can reasonably be expected to be the same as operation of the existing power plant. There will be little need for people to be visible walking the site, generally activity being within buildings. Vehicle movements would be on roads, with the nearest edge of the site roads being circa 25 m from the sea wall boundary fence. These vehicle movements would be largely screened from sight by the large buildings, coupled with the 5 m drop from the power station platform to the surrounding land. To the south there will be some screening by the sea wall and its boundary fence, coupled with the downward sloping nature of the foreshore. This operational activity can be described as a continuation of the passive low-level continuous disturbance to which wildfowl are already accustomed. As such, by comparison with existing conditions at the site there is **no impact** to the conservation status of the bird population SPA as a consequence of normal operation of the new Kingsnorth Units 5 and 6.

Construction impacts will be greater than is the case during the operational phase. Construction of the main plant will involve approximately 48 months of activity, with numerous personnel and machinery moving on the site. Most of the activity will be in the area of the existing plant, with substantial areas around the main development being used for construction laydown, temporary offices and parking, and activity confined to vehicles and personnel moving at ground level. Therefore the activity will largely be screened from the mudflats at the SPA by other buildings and boundary

sea defences, which are approximately 2 m high in the northern part of the site. These elements of the construction project would therefore constitute low-level continuous disturbance, to which wildfowl can be expected to become accustomed. There is therefore **no impact** predicted to the conservation status of the species for which the SPA is designated or to the integrity of the European site from this general level of construction activity.

However, there will inevitably some temporary episodes of construction activity that are more visible from the estuary; especially works on the jetty, but also including at higher levels on the main buildings. These potentially more disturbing episodes of construction activity are considered likely to constitute a temporary medium level continuous disturbance. Although Hockin *et al* suggest that this category of disturbance may render a site unattractive to the most vulnerable species, evidence suggests that birds have escape flight (disturbance) distances of only a few hundred metres, and less given habituation to the disturbance. This is small in relation to the large extent of the SPA. Activity amongst such species would be expected to revert to existing levels at the end of these disturbing episodes and at the construction period as a whole.

While there are mudflats and other habitats that are listed in the conservation objectives of the European site within range of these potentially disturbing construction activities, there is currently no evidence that these habitats within the immediate vicinity of the temporary construction activities are of key value in maintaining the conservation status of the bird populations for which the SPA/European site is designated. There is thus **no predicted impact on the integrity of the European site**. Nevertheless, in order to ensure that potential impacts are reduced to a minimum, wintering bird surveys are being undertaken in order to inform recommendations for mitigation, in the form of sensitive timing of works.

3.5.4.2 Qualifying Interests of the Medway Estuary and Marshes Ramsar Site

None of the 10 nationally scarce plant species listed on the Ramsar citation for the site have been recorded within the application site, and habitats within the application site do not appear to be performing a critical buffering function for populations of these species on the surrounding designated site. Furthermore, consultation with the Environmental Initiatives Officer, who has in the past been one of the BTO's WeBS voluntary recorders, indicates that the fields proposed for development within the application site are not subject to use by wintering birds for which the Ramsar site is designated and which feature in the conservation objectives for the European site.

As with the discussion above regarding the SPA elements of the European site, it is considered that use of the mudflats in the vicinity of the Longreach jetty is likely to be adjusted to current levels of industrial activity at this location, and as the development will result in no additional boat traffic and no significant difference to the configuration of infrastructure in this area, it is considered that there will be **no impact** on these bird species during the operation of the new conveyors. As set out in Section 3.5.4.1, it is considered likely that there will be no impacts to the conservation status of bird species for which the Ramsar site has been designated, and therefore no impact to the integrity of the European site during operation of the scheme. Nor are significant impacts predicted in respect of the general run of construction activities, despite some small localised increase in the noise environment and human/vehicular activity, because of the degree of screening by existing features of the area. The assessment of impacts arising from the temporary/sporadic episodes of construction activities with an increased level of disturbance is also as set out above, i.e. there is

no predicted impact on the conservation status/integrity of the Ramsar/European site. Nevertheless, in order to ensure that potential impacts are reduced to a minimum, wintering bird surveys are being undertaken in order to inform recommendations for mitigation, in the form of sensitive timing of works.

3.5.4.3 Qualifying Interests of the Medway Estuary and Marshes SSSI

Of the component species of the SSSI assemblage that bred or were recorded as using land within Kingsnorth power station during breeding bird surveys in 2006, the application site was used only by cuckoo, linnet and reed bunting. The reed bunting territories on the application site were assessed as being separate from the SSSI population, but both linnet and cuckoo potentially had territories overlapping the application site and the SSSI, hence impacts to them are assessed under this heading.

Linnet is a semi-colonial species and forages over the application site, including habitats that will be lost to the development, both temporarily and on a permanent basis. However, the application site supports sub-optimal grassland and scrub habitat of a kind that is widely available around the margins of the SSSI in this part of the Medway Estuary and Marshes. It is considered that the construction and operation of Units 5 and 6 will have **no impact** on the conservation status of the linnet population of the SSSI.

The three species on which female cuckoos are most commonly parasitic, reed warbler, hedge accentor and meadow pipit, hold territories within the application site. Of these three species, meadow pipit breeding habitat will be most affected by the proposed development. In the absence of mitigation, i.e. in the event that ecologically sensitive landscaping was not carried out, it is possible that the development could permanently reduce opportunities for cuckoo to parasitise nests in the immediate vicinity of the site, but a realistic assessment is of a temporary loss of opportunities during construction, followed by a rise in opportunities as landscaping suitable for other target species, e.g. hedge accentor, becomes established. It is therefore considered that the proposed development will have **no impact** on the conservation status of the cuckoo population of the SSSI.

The application site does not support grazing marsh or any of its characteristic and rare species listed on the SSSI citation, and nor does it appear to be performing any kind of critical buffering function for populations of these terrestrial species on the surrounding designated site. The northern drain does contain the nationally scarce brackish water-crowfoot, which is listed in the SSSI citation, and this drain is therefore considered to represent a buffer in terms of the SSSIs aquatic habitat. As no works are proposed to the northern drain, there is **no impact** to the SSSI in this respect.

Consultation with the Environmental Initiatives Officer, who has in the past been one of the BTO's WeBS voluntary recorders, indicates that the fields proposed for development within the application site are not subject to regular or frequent use by wintering birds for which the SSSI is designated. Further information from wintering bird survey is awaited to confirm the wintering distribution of SSSI-listed bird species in relation to the application site. As for the SPA and Ramsar site assessments above, use of the mudflats in the vicinity of the Longreach Jetty is likely to be adjusted to current levels of industrial activity at this location, and as the development will result in no additional boat traffic and no significant difference to the configuration of infrastructure in this area, it is considered that there will be no impact on these bird species during the operation of the new conveyors.

As with the above European site, no significant impact on the population status of birds that are the qualifying interest of the SSSI is predicted as a result of construction or operation of the new development, but mitigation will be implemented to minimise any disturbance, mainly by sensitive timing of works.

3.5.4.4 Breeding Bird Species of Local Value

In the absence of mitigation, at the site clearance stage, habitat would be lost that supports the following bird species assessed as being of local value:

- Nightingale (6 pairs)
- Turtle dove (1 pair)
- Song thrush (1 pair)
- Reed bunting (1 pair)
- Bullfinch (possibly 1 pair).

A further four nightingale breeding sites are within the application site, but the area where they occur has been excluded from the proposed construction/laydown area in order to retain the nesting habitat for this species. All of the above species also breed elsewhere within E.ON UK's landholding at Kingsnorth, principally within the Nature Reserve, which is outside the application site. In the absence of mitigation, the permanent loss of traditional breeding sites for these five species is assessed as a **significant impact at a local scale**.

Pochard, reed bunting and reed warbler are also bird species assessed as being of local importance, but the habitats that they are currently using to breed and key foraging habitats nearby are not within the areas proposed to be affected by the development and associated construction/laydown. Thus **no impact** is predicted to these three species.

3.5.4.5 Great Crested Newts

The proposed development will involve the loss of two shallow ponds (P1 and P2) that are of relatively recent origin. A single adult great crested newt was recorded at each of these ponds in 2006, but there was no evidence of their use as breeding sites; possibly due to brackish water, a relative lack of aquatic vegetation, or that they have not yet been "discovered" by adults from neighbouring ponds. These ponds will become more suitable for newts over time and, given that monitoring of the population breeding at a pond 120 m away at the Damhead Creek power station shows that population as being stable, in due course it is reasonable to assume that loss of these ponds represents a loss of potential breeding sites.

The proposed development also represents a permanent loss of good quality terrestrial habitat around the known breeding ponds at Damhead Creek Pumping Station with temporary loss of additional good quality habitat around both this and the Kingsnorth Nature Reserve garden pond. Table 3.5.2 indicates the percentage of the theoretical great crested newt range around great crested newt breeding ponds P5 and P8 represented by the proposed development. For the purpose of this assessment, the range of great crested newts is classified in accordance with the published guidance, as follows:

- "Immediate" terrestrial habitat – area within 0 – 50 m of the pond;
- "Intermediate" terrestrial habitat – area within 50 – 250 m of the pond;
- "Distant" terrestrial habitat – area within 250 – 500 m of the pond.

The term "Total Range" is used to refer to the whole of the area within a 500 m radius of a pond. The area of a circle with a radius of 500 m around a point is approximately 78.55 ha (785,500 m^2). Of this, the area within the "Immediate" portion of the theoretical range is 0.79 ha; the area within the "Intermediate" portion of the theoretical range is 18.85 ha and the area within the "Distant" portion of the theoretical range is 58.91 ha. The areas below consider the loss of habitats within these different parts of the range around breeding sites during the phase maximum, i.e. at the construction stage, in the absence of mitigation.

Table 3.5.2 : Theoretical Range of GCNs Impacted by Proposed Units 5 and 6

Pond No. as shown in Figure 3.5.3	Distance from Application Site (m)	Category of Range	% of GCN this Theoretical Range Lost During Construction
P5	45 - 50	Immediate	0
	50 - 250	Intermediate	36.6
	250 - 500	Distant	13.6
	45 - 500	TOTAL RANGE	19
P8	N/A	Immediate	0
	50 - 250	Intermediate	11.7
	250 - 500	Distant	13.4
	50 - 500	TOTAL RANGE	12.9

As great crested newts are protected by law, it is certain that site clearance and construction will need to be carried out under a licence issued by Natural England. This process of licensed exclusion will ensure that there is no significant disturbance or damage to great crested newts during the site clearance stage. However, the legislation protecting great crested newts also requires that a planning authority must be satisfied that mitigation is in place to maintain this European protected species at a favourable conservation status before it grants planning consent. This means there must be a commitment to produce a Mitigation Strategy at the planning application stage.

In the absence of mitigation, loss of terrestrial habitat around known breeding ponds P5 and P8 during construction, as detailed above, plus loss of two ponds with some potential for breeding in the future would be considered to be a **significant impact at a local scale**. The habitats at the northern construction laydown area (TN 27) are sub-optimal for great crested newts, and especially when viewed in the context of the good quality habitats to the east it is considered unlikely that loss of this area will increase the level of impact on this species, if it is present. It would, however, extend the requirement for a Mitigation Strategy for the species to encompass this parcel of land. The net reduction in habitat once the development is complete will be less than detailed above, and site landscaping will be designed and managed in an ecologically sensitive manner in order to ensure the long-term suitability of habitats

on site for this species. Post-completion the site will have sufficient land to achieve mitigation within the boundaries of the site. Hence, as the scheme will be subject to licensing, no adverse impact is predicted for this species in the operational stage.

3.5.4.6 Water Voles

The scheme does not involve any works to the northern drain, or to the adjacent sea defence bund, which lies between the drain and the development area. Consequently there is **no impact** predicted to this species.

The southern drain (TN 20), which does not currently support water voles but has potential to be colonised by this species, also appears to be unaffected by the proposed works. As there is no bund to physically protect this drain during construction, mitigation is recommended to prevent accidental damage.

3.5.4.7 Divided Sedge

It is certain that the area in which there is a small population of divided sedge will be lost during the site clearance stage, as it occurs in a long marshy hollow that bisects the main construction laydown area adjacent to the development. In the absence of mitigation, the loss of this colony from the site would be considered to be **significant at the local scale**.

3.5.4.8 Badgers

The location of the single-hole sett within the application site means that it is impracticable to retain it in the construction laydown area, and the two-hole sett is also within an area shown as being required for construction laydown, so both setts will be lost. As badger setts are protected by law, it is certain that if they remain in occupation their destruction will need to be carried out under a licence issued by Natural England. This process of licensed exclusion will ensure that there is no significant disturbance or damage to badgers during the site clearance stage.

There will be a temporary loss of foraging habitat for badgers during construction, but there will be no loss of access to drinking water. In view of the fact that foraging activity in the area appears to be minimal, and other areas of grassland and scrub will remain available, it is considered that the temporary reduction in foraging habitat is unlikely to have an adverse effect on badgers.

In terms of the operational phase, the site offers alternative sites for the excavation of setts, or for an artificial sett to be provided (if compliance with legislation requires this, based on future conditions), and even in the absence of mitigation through ecologically-sensitive design, site landscaping would be likely to result in foraging habitat that is of at least similar quality to that presently available.

In view of the above, there is **no significant impact** predicted on badgers, although mitigation measures are proposed to ensure legislative compliance.

3.5.4.9 Reptiles

The layout of the proposed development has been adjusted during the masterplanning stage to provide a buffer around the Nature Reserve, which will serve to prevent impacts to reptiles in the northern half of TN 8, where the greatest numbers seem to be concentrated. There will, however, be loss of a small area of coarse wet grassland in the southern part of TN8, which is the only part of the application site where a single grass snake was recorded. As grass snakes are relatively faithful to their sites, in the absence of mitigation, works to this area could result in harm to individual animals during the site clearance stage. There is a good breeding population of grass snakes in the Nature Reserve, and it is considered that the loss of the southern part of TN8 will be **unlikely to have a significant effect on the conservation status of this species** locally.

There are breeding populations of common lizard and slow worms in the Nature Reserve, and both species also occur in suitable habitats throughout the application site, and beyond. As reptiles are protected by law, it is certain that site clearance will need to be carried out adopting reasonable measures to minimise the potential for harm to reptiles, but in the absence of mitigation, the size of the area to be cleared means that there will be a localised reduction in the carrying capacity and thus the size of the populations of common newt and slow worm in the immediate and short-term. This is an **impact of significance only in the context of the site**.

In the medium- to long-term, i.e. during the operational stage of the development, a significant portion of the site will be returned to vegetated landscape that will provide opportunities for recolonisation by reptiles. The temporary loss of available habitat in the application site is considered likely to have **no significant adverse impact** on the conservation status of the local populations of any of these species.

3.5.4.10 Common Breeding Birds

Site clearance will result in the loss of breeding habitat for a range of common bird species. The **impact is of significance only at the level of the site**, but legislation requires that reasonable measures are taken to avoid damage to these birds, and their nests and eggs, whilst breeding.

3.5.4.11 Other Habitats

Table 3.5.3 below summarises habitat loss associated with the development as currently proposed.

Table 3.5.3 Summary of Habitat Loss for Units 5 and 6

Habitat	Area Lost
Hardstanding, scub and ephemeral habitats (at TN6)	2.3 ha
Improved and semi-improved grassland (amenity and hay meadow)	17.5 ha
Semi-improved neutral grassland at TN 16	3.7 ha
Broadleaved plantation and semi-natural woodland (TNs 1, 3 and 7)	4.2 ha
Grassland, tall herbs and scrub (TNs 4 and 8)	3.7 ha
Standing water	2 shallow ponds

3.5.5 Mitigation

On the basis of surveys and assessment carried out to date, there are no in-principle ecological constraints to development of Units 5 and 6 at Kingsnorth power station. However, there is potential for some impacts of significance at a local scale, and so mitigation measures are proposed. In this section, mitigation measures are described under three sub-headings, which correspond with the three main stages of the development process that would follow the granting of outline planning consent(s) for the development.

3.5.5.1 Detailed Design Stage

Ecologists have had input to the current layout of the proposed development, providing a range of advice on ecologically sensitive design. The ecology mitigation strategy for the development is based on a three ecological design principles: habitat retention, habitat creation and habitat enhancement.

Habitat Retention

The first principle of the Strategy is to “design out” and thus avoid impacts wherever possible. For example, by retaining habitats of value for reptiles and breeding nightingales as a buffer between the construction laydown area and the Nature Reserve, which has been retained and incorporated into the layout of the site.

Habitat Creation

Where features do not warrant retention and cannot practicably be retained in situ, but similar habitat could be replicated and maintained elsewhere within the site, then the opportunity will be taken to create new habitats of similar nature to those lost. For instance, new ponds in the easternmost part of TN16 will provide replacement habitat for the great crested newts and there is potential to provide similar damp habitat for grass snakes in suitable habitat elsewhere, e.g. around the Nature Reserve. Site landscaping will be designed and managed in an ecologically sensitive manner in order to ensure the long-term suitability of habitats on site for these species. In view of the fact that the waterbodies on site contain brackish water that may not be suitable for successful great crested newt breeding, particular attention will be paid to replacing the existing ponds P1 and P2 with alternative waterbodies that can be expected to contain freshwater.

The principles of habitat creation will be applied to all of the site landscaping. Opportunities for use by a range of wildlife will be incorporated into all of these areas, irrespective of whether their primary purpose is for ecological mitigation. Awareness of implications when making decisions regarding species/varieties chosen will maximise the value even of areas with a mainly formal landscape purpose. For instance, in terms of flowering trees, shrubs and herbaceous species, more important than the choice of native versus non-native species may be decisions over flower-structure or fruit colour, which determine their value as food sources for wildlife.

Any perimeter landscaping will be landscaped with a predominantly native tree and shrub woodland mix based on appropriate National Vegetation Classification (NVC) communities. Using specimens of British (rather than continental European) provenance would have sustainability benefits in terms of optimal establishment and disease resistance.

As part of the strategy to maximise the ecological value of the new features of the site, scheme engineers and designers will take into consideration advice on ecologically sensitive design principles. The opportunity will be taken to optimise the value of areas of grassland and planting to invertebrates, and thus to the birds and bats that feed on them, through the use of attractive mixes. These mixes will be based upon locally appropriate NVC communities, especially for habitats featured in the UK Biodiversity Action Plan (BAP) and Local BAP for Kent, and the Greater Thames Estuary Coastal Natural Area documentation, which are nature conservation initiatives that will be used to guide the detailed design of new habitats on site.

In particular, where species-rich grassland is recommended, care will be taken to ensure that non-agricultural grass cultivars are used in combination with commonly occurring locally native wildflowers. Rare or scarce species will not be introduced into newly created grasslands, as this could obscure and confuse understanding of the "natural" distribution of such species. Where practical, sourcing of other herbaceous plants will be in accordance with the principles of Flora Locale, which is a conservation initiative centred on sourcing plants and seed of verifiable British provenance.

Habitat Enhancement

In tandem with the above habitat retention and creation measures within the planning application site, an assessment is being made of the potential to enhance the ecological value of habitats elsewhere in the application site.

Measures will be put in place as follows:

- Replacement of some areas of shrubs with new planting of greater value to wildlife;
- Augmentation of some existing vegetation with new species to enhance its value as habitat;
- Altered management, e.g. mowing regimes, to diversify structure of microhabitats;
- Installation of features such as bird and bat boxes; and
- A management plan for the site to enhance its habitat value for great crested newts.

These measures will be co-ordinated to complement design and management measures within the newly developed areas, so as to optimise the ecological value of the site as a whole in the short-, medium- and long-term. A particular focus of this element of the project in existing developed parts of the site will be to ensure that habitat for black redstart is maintained.

3.5.5.2 Site Clearance and Construction Stage

In addition to the design stage, the construction stage of the project will also be based upon principles designed to maintain and enhance the biodiversity of the site. An Environmental Management Plan (EMP) will be developed, with Construction Method Statements for activities in areas of sensitivity.

The following general principles will be applied when considering the mitigation of adverse impacts on ecology during construction.

Monitoring Change

The full development of the site can be expected to take up to five years. During that time, in the absence of management, the ecological character of the undeveloped parts of the site could change significantly, due to the process of ecological succession. During this process, the nature conservation value of the habitats on site will change, as will the complement of species that they support. In recognition of the dynamic nature of habitats on site, ecological monitoring will be undertaken. In particular, further checks for bats by a suitably experienced bat ecologist at the correct time of year will be required at the two structures at TN 2 and TN 5.

This monitoring will mean that up-to-date knowledge can be used by a suitably experienced ecologist, referred to as the "site ecologist", to provide input on nature conservation issues to decision-making about the siting and scheduling of further development on the site. The site ecologist will develop mitigation and enhancement measures that will be co-ordinated with the EMP to ensure that ecological impacts during construction are minimised. For instance, any trees and shrubs that cannot be retained will be taken down before the bird breeding season and, where areas used by reptiles are going to be affected, then advice would be provided on how/where other parts of the site can be managed ahead of construction to make them more suitable for use by the reptiles.

Obtaining Licences

As protected species are present within the site, the statutory nature conservation agency, Natural England, will be consulted and agreement reached as the requirement for licensing construction activities on site.

The only protected species on site that are likely to be affected by works and require work under licence are great crested newts and badgers. If the programme of site monitoring found evidence of these species and there was potential for them to be damaged or disturbed during construction, then consultations over mitigation would be held with Medway District Council and Natural England, and appropriate licences obtained, if necessary.

Definition of Working Areas

The working areas, including temporary access tracks, will be kept to a practical minimum through areas of vegetated habitat, and their boundaries will be clearly delineated at the commencement of works. The site ecologist will be consulted in decision-making over areas proposed for use as construction compounds or site storage areas, so that sensitive habitats are avoided wherever possible.

Protective Fencing

Existing vegetation to be retained, or other areas defined by the site ecologist as requiring protection from accidental damage or disturbance, will be securely fenced prior to the commencement of site clearance. The area enclosed within the fencing will include the root systems of the vegetation affected. Fencing will be fit for purpose ("Netlon" or similar is not suitable) and be clearly visible to drivers of large construction vehicles. No materials storage will be permitted within the fenced areas. The fences will be maintained to ensure their continued function throughout construction, but will be removed from site on completion of the works.

Retention and protective fencing is recommended at the following locations:

- Edge trees/woodland to be retained for screening at Holm Lodge Wood;
- Environmental Protection (buffer) Zone to be retained adjacent to Nature Reserve;
- To the west of the line of white poplar trees along the drain at TN 12;
- Around any badger setts that are to be retained (if this is considered possible);
- At the foot of the flood protection bund along northern drain;
- Around the other Environmental Protection area for great crested newts at the eastern end of TN 16;
- Along northern side of drains at TN 19 and TN 20 to prevent accidental damage;
- Around/within the PFA/lagoon areas, if any activity is required in these areas;
- Along any of the boundaries with the SSSI/SPA/Ramsar site, if works are close by.

Minimising Risk of Nuisance

Good construction site management will be implemented to avoid/minimise generation of excessive litter, dust, noise and vibration. This will be controlled and monitored through the EMP.

Protection of Water Quality

Good construction site management will be implemented to avoid/minimise potential for problems such as fuel and other chemical spills. There will be no storage of potentially contaminating materials in areas of hydrological sensitivity, e.g. in the vicinity of the drains that lead to the SSSI/SPA/Ramsar site. A Pollution Incident Response Plan will be included as part of the EMP to ensure that impacts from any potential accidental spill are reduced to a minimum.

The draining of the ponds P1 and P2 will be subject to a specific Construction Method Statement, drawn up with inputs from a suitably experienced ecologist, to minimise the potential for adverse effects on the wildlife using the pond, which includes great crested newts and a range of aquatic invertebrates.

Arrangements for dewatering will be agreed with the Environment Agency and the planning authorities.

Ground Preparation and Restoration

Where present, topsoil should be removed and stored separately from the underlying subsoil in piles less than 2 m high. Topsoil, in particular, should be stored for as short a time as possible. When ground affected by construction works is being restored, subsoils should be placed beneath topsoil, and steps taken to ensure that the new surfaces will settle so as to be flush with the surrounding ground level.

Minimising Potential for Impacts on Breeding Birds

The nests, eggs and young of even common species of wild bird are protected from deliberate damage during the breeding season (March to July inc.) under the terms

of the Wildlife and Countryside Act 1981, as amended. Although damage to breeding sites may be the incidental result of a lawful operation, such as the implementation of a planning consent, it is best practice to minimise the potential for such damage by removing vegetation likely to be used by breeding birds outside of the season if at all possible. Alternatively, a search of vegetation by the site ecologist immediately prior to clearance is recommended, so that breeding sites can be identified and their clearance delayed until any young have fledged.

Minimising impacts to breeding ground-nesting birds such as meadow pipits presents a different challenge, as their breeding habitat cannot be removed, and thus the timing of construction works becomes an important issue. Where possible, works of short duration in or close to the main areas used by ground-nesting birds will be scheduled to take place outside of the bird breeding season. Where this is impracticable, e.g. due to wet winter ground conditions, or where works are of longer duration, a different approach may be required.

The preferred option under these circumstances will be to manage another part of the site to make it more suitable for ground-nesting species, while at the same time implementing measures to deter birds from establishing breeding territories within the area affected by the impending works. Commencing construction activity before the arrival of the birds in March and April, so that levels of human and vehicle activity are high on the construction site during the birds' territory establishment phase, is likely to be successful in deterring most birds and encouraging them to seek out alternative habitat nearby.

Minimising Potential for Impacts on Wintering Birds

Although no significant impacts on species for which statutory sites are designated are predicted, it is considered appropriate to take all reasonable measures to reduce the potential for any disturbance impacts to a minimum. The mitigation that seems most likely to be appropriate in relation to wintering birds is in terms of controlling the seasonality and/or timing of works to the conveyor system on the Longreach Jetty. The details of the most appropriate timing will be determined by the way in which the wintering birds use the site locally, i.e. will be determined through further consultation with local recorders and the outcome of ongoing surveys.

Minimising Potential for Impacts on Amphibians

A Mitigation Strategy for great crested newts will be prepared. It is recommended that new freshwater ponds be created, ideally at least 12 months in advance, before ponds P1 and P2 are drained and infilled at a suitable time of year to minimise any detrimental impact to wildlife. This draining down would be outside the amphibian breeding season and, given that great crested newts are not currently breeding at these ponds, the best time would be from approximately November – February. This would allow any invertebrates to emerge from the ponds and would also be outside the bird breeding season and the times of year when reptiles may be using the grassland around the ponds.

Given the apparently limited use of the site by GCNs during their terrestrial phase, it is considered that terrestrial habitat is not likely to be the limiting factor on this population. It may therefore be possible to exclude the development site under licence without the need for a substantial translocation scheme, and as an alternative to provide new freshwater pond and hibernation habitat within a slightly reduced area managed specifically for the benefit of this species.

3.5.5.3 Completed Development

Management Plan

It is likely that the great crested newt mitigation will require monitoring for a minimum period of five years post-completion.

Continuation of the ongoing monitoring of the site and the continuing nature conservation management by the Environmental Initiatives Officer, or a more formal whole-site management plan, will ensure that the site will be managed to maximise its nature conservation value as a whole.

As site staff and local groups have demonstrated an interest in the ecology of the site, it may be appropriate to consider additional elements to the site, to permit users of the site to have closer contact with the wildlife there. Opportunities that could be considered could include:

- Extension to the existing Nature Reserve.
- Implementation of a bird-box scheme using boxes of different designs to accommodate a variety of species across the wider site. A barn owl box could be successful, given the presence of this species locally and the suitability of habitats.
- Extension to the current bat box scheme at the Nature Reserve could also be considered.
- CCTV links to some bird boxes/overlooking the peregrine site on the chimney, so that the activities of the birds can be observed.
- Use of sustainable technologies, e.g. green/brown roofs, renewable energy.

3.5.6 Residual Effects

The implementation of ecological mitigation measures in accordance with the principles set out in Section 3.5.5 above will reduce potential impacts of significance at the local scale, i.e. those that could constitute a material consideration in terms of the planning application, to being of significance at a low scale, i.e. in the context of the site. Assuming that the above mitigation principles are applied, the significance of the residual impacts of the development of Units 5 and 6 at Kingsnorth power station would be as set out in Table 3.5.4 below.

Table 3.5.4 : Summary of Residual Ecological Impacts

Feature of Interest	**Geographical Scale of Adverse Significant Impact Before Mitigation**	**Mitigation Measures**	**Residual Impact**	**Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)**
CONSTRUCTION STAGE				
Qualifying Interest of SPA	NO IMPACT ON STATUS but cannot rule out entirely some temporary localised disturbance to birds	Retention of habitats in design Mitigation Strategy Sensitive timing of works Protection of habitats during construction	Reduced to a minimum	NO IMPACT ON STATUS OR INTEGRITY
Qualifying Interests of Ramsar site	NO IMPACT ON STATUS but cannot rule out entirely some temporary localised disturbance to birds	Retention of habitats in design Mitigation Strategy Sensitive timing of works Protection of habitats during construction	Reduced to a minimum	NO IMPACT ON STATUS OR INTEGRITY
Qualifying Interest of SSSI	NO IMPACT ON STATUS but cannot rule out some temporary localised disturbance to birds	Retention of habitats in design Mitigation Strategy Sensitive timing of works Protection of habitats during construction	Reduced to a minimum	NO IMPACT ON STATUS OR INTEGRITY

Feature of Interest	Geographical Scale of Adverse Significant Impact Before Mitigation	Mitigation Measures	Residual Impact	Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)
CONSTRUCTION STAGE				
Breeding bird assemblage comprising five species of Local value, including 6 of 8 sites used by breeding pairs of nightingale in 2006	LOCAL Temporary breeding habitat loss during construction	Retention of habitats used by 4 pairs of nightingales adjacent to Nature Reserve. Protective fencing during works.	Temporary loss of only 2 nightingale territories, plus one each for the other 4, during construction.	LOW NEGATIVE
Great crested newt terrestrial habitat and 2 potential breeding sites	LOCAL Loss of newts during site clearance. Ponds not currently used for breeding, but site clearance amounts to significant reduction in terrestrial habitat for the duration of construction.	Retention of habitats in design Mitigation Strategy Enhancement elsewhere in advance, e.g. pond creation Ongoing monitoring Licensed exclusion/clearance Protection of habitats during construction	Temporary disturbance to newts during capture	NEUTRAL At worst, as licensing is a statutory process that can be relied upon to ensure no adverse impact on conservation status of the species and minimises risk to individual newts.
Water voles – potential for future presence at TN 20	No impact at present but need to comply with legislation and take reasonable measures to avoid damage	Retention of habitats Ongoing monitoring Mitigation Strategy if water voles found Protection of habitats during construction	Temporary disturbance to water voles during exclusion and localised works	NEUTRAL

Feature of Interest	Geographical Scale of Adverse Significant Impact Before Mitigation	Mitigation Measures	Residual Impact	Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)
CONSTRUCTION STAGE				
Divided sedge at TN 15	LOCAL Loss of colony during site clearance.	Mitigation Strategy Enhancement elsewhere in advance Transfer of plant materials Ongoing monitoring	Natural distribution altered, but species retained within site	NEUTRAL
Two badger setts	LOW Not significant in nature conservation terms, but disturbance to badgers and loss of setts means requirement to comply with legislation	Consider retention of setts in design Mitigation Strategy Enhancement elsewhere in advance Sensitive timing of works Licensed exclusion/clearance Ongoing monitoring	Disturbance to badger setts and foraging behaviour	LOW NEGATIVE
Presence of reptiles	LOW Potential for harm to reptiles means requirement to comply with legislation	Retention of habitats in design Mitigation Strategy Enhancement elsewhere in advance Ongoing monitoring Exclusion/clearance Protection of habitats during construction	Temporary disturbance to newts during capture, and likely temporary reduction in populations	LOW NEGATIVE

Feature of Interest	Geographical Scale of Adverse Significant Impact Before Mitigation	Mitigation Measures	Residual Impact	Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)
CONSTRUCTION STAGE				
Presence of other breeding birds	LOW Not significant in nature conservation terms, but damage to breeding birds means requirement to comply with legislation	Retention of habitats in design Protection of habitats during construction Sensitive timing of works	Temporary reduction in breeding habitat and disturbance to nest sites	LOW NEGATIVE
Other habitats	LOW	Retention of habitats in design Protection of habitats during construction	Temporary reduction in vegetated habitats	LOW NEGATIVE
Nature Reserve	LOW Localised disturbance	Retention of habitats in design Protection of adjacent habitats during construction	Disturbance minimised.	LOW NEGATIVE
OPERATIONAL STAGE				
Qualifying Interest of SPA	No impact	N/A	N/A	NEUTRAL
Qualifying Interests of Ramsar site	No impact	N/A	N/A	NEUTRAL
Qualifying Interest of SSSI	No impact	N/A	N/A	NEUTRAL

Feature of Interest	**Geographical Scale of Adverse Significant Impact Before Mitigation**	**Mitigation Measures**	**Residual Impact**	**Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)**
OPERATIONAL STAGE				
Breeding bird assemblage comprising five species of Local value, including 6 of 8 sites used by breeding pairs of nightingale in 2006	LOCAL Permanent breeding habitat loss if landscape design and management insensitive	Target species for specific habitat creation Sensitive management in long-term	Small net increase in suitable habitat available to these species in the long term	LOW POSITIVE
Great crested newt terrestrial habitat and 2 potential breeding sites	LOCAL Permanent reduction in terrestrial habitat available in the long term. NB. This is a "theoretical" impact as the scheme will not be licensable unless it can be shown that there will be no adverse impact on this species during operation.	Target species for specific habitat creation Sensitive management in long-term	Maintenance of habitat suitable for foraging, hibernation and potentially for breeding in the long term	NEUTRAL At worst, as licensing is a statutory process that can be relied upon to ensure no adverse impact on conservation status of the species and minimises risk to individual newts.
Water voles – potential for future presence at TN 20	No impact at present	N/A	N/A	NEUTRAL

Feature of Interest	Geographical Scale of Adverse Significant Impact Before Mitigation	Mitigation Measures	Residual Impact	Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)
OPERATIONAL STAGE				
Divided sedge at TN 15	LOCAL Permanent loss of colony if landscape design and management insensitive	Target species for specific habitat creation Sensitive management in long-term	Maintenance of species within site in the long term, with potential for increase	NEUTRAL TO LOW POSITIVE
Two badger setts	LOW Permanent loss of setts if landscape design and management insensitive	Target species for specific habitat creation Sensitive management in long-term	Maintenance of habitat suitable for foraging, and setts in the long term	NEUTRAL
Presence of reptiles	LOW Permanent significant reduction in populations if landscape design and management insensitive	Target species for specific habitat creation Sensitive management in long-term	Maintenance of habitat suitable for foraging, hibernation and r breeding in the long term	NEUTRAL TO LOW POSITIVE
Presence of breeding birds	LOW Permanent reduction in populations if landscape design and management insensitive	Target species for specific habitat creation Sensitive management in long-term	Maintenance of habitat suitable for foraging, hibernation and potentially for breeding in the long term	NEUTRAL TO LOW POSITIVE

Feature of Interest	Geographical Scale of Adverse Significant Impact Before Mitigation	Mitigation Measures	Residual Impact	Scale of Impact After Mitigation, and Whether Negative, Neutral or Positive)
Other habitats	LOW Permanent loss of colony if landscape design and management insensitive	Target for specific habitat creation Sensitive management in long-term	Partial replacement with new habitats of biodiversity value	NEUTRAL TO LOW NEGATIVE
Nature Reserve	LOCAL Permanent fragmentation if landscape design and management insensitive	Consider increasing size of Nature Reserve Target species for specific habitat creation Sensitive management in long-term	Improved buffering and increase in size. Restoration of habitat links with wider site	NEUTRAL TO LOW POSITIVE

3.5.6.1 Compliance with the Habitats Regulations – Summary for Appropriate Assessment

The potential effects of the scheme on the qualifying bird populations cited in the SPA and Ramsar site Natura 2000 forms (see Appendix D1), which are listed on the conservation objectives produced by Natural England for the Medway Estuary and Marshes European site (see Section 3.5.1.2.3 above) have been assessed. Key information on the effects to the European site is presented below, to be taken into consideration by the competent authority responsible for making the appropriate assessment under the Habitats Regulations.

The Long Reach jetty, which crosses the mudflats south of the existing power station, is the only part of the scheme that lies within the European site, and none of this habitat will be lost or directly affected. The parts of the application site where works are proposed do not contain any of the other habitats named in the conservation objectives as supporting the bird interest of the European site.

Consultation with the Environmental Initiatives Officer, an experienced ornithologist, indicates that bird species listed in the conservation objectives do not use the development and associated construction laydown areas, and from WeBS data it appears that the area in the vicinity of the jetty is not used preferentially by these species either. Annex 1 breeding birds avocet and little tern are not breeding within 1 km of the proposed works and foraging impacts are considered unlikely. This area is already subject to a degree of noise/disturbance due to the current activities, and it is assumed that wildfowl locally are accustomed to this. The main construction site is screened from the European site by existing buildings and/or sea defence bunds, so

the main construction activity is considered unlikely to have a significant effect on bird activity local to the site.

It is acknowledged that certain elements of the construction programme, e.g. works on the jetty or at height on the new buildings, may constitute more disturbing activities in respect of any wintering birds within the area. Research suggests that this kind of temporary medium level continuous disturbance may render a site unattractive to the most vulnerable species, but evidence produced by English Nature suggests that birds have escape flight (disturbance) distances of only a few hundred metres, and less given habituation to the disturbance. This is small in relation to the large extent of the SPA. Activity amongst such species would be expected to revert to existing levels at the end of these elements of construction and at the construction period as a whole. Thereafter, operational effects of the scheme will be as at present.

Given the sensitivity of the European site, wintering bird surveys are underway, and the results will be added to existing information on the site in order to produce a Mitigation Strategy, largely based around the sensitive timing of works, that will be designed to reduce disturbance effects to a practicable minimum.

In view of the above, it can be stated with a high degree of confidence that the proposed development of Units 5 and 6 at Kingsnorth power station will not have an adverse impact on the conservation status of the bird species cited in the conservation objectives for the Medway Estuary and Marshes SPA/Ramsar site, and thus there will be no impact on the integrity of this European site as a consequence of the scheme.

3.5.6.2 Compliance with Other Legislation

Mitigation during the design and site clearance stages includes measures to directly mitigate for protected species known currently to be present, including obtaining licenses if/when required.

As a precaution, the recommendations also include reasonable procedures that can be put in place to ensure that any changes in use of the site by protected species, or arrival of new protected species, will be detected in timely manner. In addition to avoiding unforeseen delays to programme, this will ensure compliance with the relevant legislation by avoiding reckless damage or disturbance and minimising the potential for accidental damage or disturbance.

3.5.6.3 Compliance with Planning Policy

The parts of the application site proposed for development and/or construction laydown area are not, from the best available evidence, considered to play a role in supporting or buffering the adjacent SSSI/SPA/Ramsar site. There is thus no conflict with Medway Local Plan policy **BNE 35** (International and National Nature Conservation Sites).

In relation to policies **BNE 37** (Wildlife Habitats) and **BNE 39** (Protected Species), after mitigation, it is reasonable to anticipate that locally significant impacts to great crested newts and divided sedge during construction can be reduced to being neutral (i.e. not materially different from at present), whilst impacts of significance in respect of locally important bird species will be reduced to an adverse impact in the context of the site. Low adverse impacts at this stage to badgers, reptiles, common bird

species, other habitats and the Kingsnorth Nature Reserve will also be reduced to a practicable minimum by the recommended mitigation measures.

Similarly, with mitigation in place during the operational stage, otherwise locally significant negative impacts on birds of nature conservation value, great crested newts and divided sedge, and low negative impacts on badgers, reptiles and common bird species and the Nature Reserve are all assessed as being either neutral or positive in the context of the site in the medium- to long-term. The permanent reduction in the extent of vegetated habitat within the Kingsnorth power station site as a whole is the only negative residual impact during the operation of Units 5 and 6, and this impact is only of significance in the context of the site.

REFERENCES

Hill D, Hockin D, Price D, Tucker G, Morris R & Treweek J, (1997). Bird disturbance: improving the quality and utility of disturbance research. Journal of Applied Ecology, **34,** 275-288.

Hockin D, Ounsted M, Gorman M, Hill D, Keller V & Barker M A, (1992). Examination of the effects of disturbance on birds with reference to its importance in ecological assessments. Journal of Environmental Management **36**, 253-286.

Murton R K, (1971). Man and Birds. London Collins.

3.5.7 Aquatic Ecology

The outer Medway Estuary supports a diverse fish community and provides a nursery ground for some flatfish species including sole, plaice, dab and flounder. There are two known bass spawning areas in the Tidal Medway, near to Grain power station and Kingsnorth power station discharges. Bass and bass fry favour elevated water temperatures particularly adjacent to the power station outfalls within the outer estuary. This phenomenon has been recognised and a "no fishing" box has been created in these areas that are designated under "The Bass (Specified Areas) (Prohibition of Fishing) Order 1990" to protect the juvenile stocks from exploitation.

EA (Kent Fisheries Department) has recorded 5 years data over 1997 – 2001, with monitoring at 5 locations along the whole length of the Medway tideway. Fish surveys of the Outer Thames Estuary and Medway Estuary have also been undertaken by CEFAS and the EA for the November periods in 1999 and 2000. Some data relevant to the Kingsnorth power station site are contained in these reports.

Table 3.5.4 gives estimates of the most frequently encountered fish species in the Upper Medway (Analysis using 20 years of data (to 1993) compiled by the Fawley Aquatic Research Laboratory). All fish from these results have been found in the intake screens of Kingsnorth power station, or in the discharge canal. Medway Estuary Fishery Survey reports for 2000 and 2001 also give the results of trawl surveys by CEFAS at the Kingsnorth intake area (Table 2).

Table 3.5.4: Relative Abundance of the most frequently encountered fish species in the Upper Medway (Analysis using 20 years of data (to 1993) compiled by the Fawley Aquatic Research Laboratory

Common Name	% Relative
Sprat	53
Whiting	11
Sand Goby	10
Herring	10
Pout	5
Dab	2
Flounder	2
Sand Smelt	1.5
Silver Eel	1.5
Plaice	1
Sole	1
Great pipefish	1
Poor cod	0.4
Black goby	0.2
Dragonet	0.2
Thin-lipped mullet	<0.1
5-bearded rockling	<0.1
15-spined stickleback	<0.1
Sea snail	<0.1
Bass	<0.1

Table 3.5.5 Medway Estuary Fisheries surveys (CEFAS trawl Results 1999 & 2001) Kingsnorth Intake

	25/11/1999	14/05/2001
Bass	169	3
Dover Sole	1	8
Eel		3
Flounder	3	7
Goby		3
Pipefish		6
Poor cod	1	
Bib	72	
Whiting	43	1
Smelt		30
Herring	1	
Sprat	1	4
Twaite shad		1

Bass spawn in the North Sea and the fry move inshore to the estuary nursery areas from an early age. Similarly herring spawn on the Eagle Bank and off Whitstable within the Thames estuary and the fry migrate inshore. Conversely, smelt probably spawn in the upper Medway estuary and the fry spread downstream into the intertidal zone.

Gill netting at the upstream site of Allington in the Medway in August 1996 captured 2 twaite shad (*Alosa falax*) and 1 allis shad (*Alosa alosa*). Although these species had been found as adults in the river, no juveniles had been caught and there was no indication in 1997 that a spawning area was present in the River Medway. Shads are protected by the Schedule 5 of the Countryside and Wildlife Act, 1981 and EC legislation. Both species of shad are listed on the Appendix II of the Bern Convention and also on Annexes II and V of the Habitats Directive. When these species are present the EC legislation states that it is not permissible to fish by any means that may eradicate the population in the area. If a spawning area for a listed species was located on the Medway then that area could be registered as a Special Area of Conservation or a Site of Special Scientific Interest which would then be attributed a high level of environmental protection.

Both species of shad are included in the UK Biodiversity Action Plan Steering Group (BAPSG) list of priority species. However, the Kent BAP identifies that these species are rare and present as in an 'outlying' part of their geographical range rather than in a 'stronghold'.

The Environment Agency has long term objectives of re-establishing the migratory salmon and sea trout fisheries within the Medway. Salmon and sea trout will migrate through the estuaries up to temperatures of 20 ^{o}C and 25 ^{o}C. EIFAC have set up standards for freshwater species, and these were transposed into the Freshwater Fisheries Directive in 1978. These standards do not apply to transitional or coastal waters. However, the Thames Region of the Environment Agency has applied the 21.5^{o}C standards on the Thames estuary in recent years to protect salmon migrations against any new thermal pressures.

POTENTAL IMPACTS

Entrainment

It is intended to use the existing cooling water intake and discharge system for the new units. This will minimise disturbance to the estuary, and re-use of the civil structures will minimise generation of waste materials. The original cooling water circuit design was to serve four 485MW generating units whereas the proposed new units will have two 800 MW generating units, with higher thermal efficiency. Consequently cooling requirements will be significantly reduced. Although this is likely to reduce the water flow requirements (from the current 61.9 $m^3 s^{-1}$ flow to possibly around 46.4 $m^3 s^{-1}$) it is uncertain at present whether this will be the case. It is therefore assumed here that flow rates are unchanged as a worst case assumption.

Abstraction of water has the potential to draw fish into the cooling water system to either be trapped on the intake screens or to pass through these into the cooling water circuit (for the purposes of this report, both are included in the term entrainment). Factors that would increase entrainment of fish into the cooling water systems include:

- Abstraction velocities that exceed the fish swimming abilities
- Offshore intake designs that are open at the top ('bath plug-hole' type) with vertically descending flows that are hard for fish to avoid
- Fish failing to recognise the danger at night or with high turbidity

The depth of water at the intakes and hence the intake area and water velocity varies with state of tide. Taking the area between the concrete pillar structures at the entrance to the intake, that would form a point of reference for any fish being entrained, flow for the existing plant is estimated to be 28 cm s^{-1} for mean low water spring tide and 11 cm s^{-1} for mean high water spring tides with an average of approximately 20 cm s^{-1}.

Estimates have been made of maximum approach velocities that enable fish to escape at different water temperatures[3]. The following table shows these velocities (cm s^{-1}) for age 0+ fish of each species.

[3] Turnpenny AWH, 1988 The behavioural basis of fish exclusion from coastal power stations cooling water intakes. CEGB Report RD/L/3301/R88

2 Turnpenny, AWH and Coughlan J, 2003 Using water well, Studies of power stations and the aquatic environment. Joint Environmental Programme.

Table 3.5.6 Maximum approach velocities that enable fish to escape at different temperatures

Species	2.5 °C	7.5°C	12.5°C	17.5°C
Sprat	30	40	50	60
Herring	30	40	50	60
Cod	15	30	40	55
Whiting	10	25	40	50
Pout	8	15	20	29
Poor Cod	10	25	35	50
Plaice	8	15	20	30
Flounder	10	20	30	40
Dab	2	10	20	26
Sole	5	15	20	30
Bass	20	35	50	66
Grey Mullets	20	35	50	60
Sand Smelt	10	20	30	40

These 'escape velocities' are generally higher than the 20 (11 – 28) cm s^{-1} estimated at the intake screens apart from for some of the flat fish species and in very cold water conditions. The design of the intake has vertical columns supporting the CW structures with a vertical coarse bar screen system behind (with slot widths of 51mm) through which water flows horizontally. The columns and screens will provide a visual reference for fish being entrained in other than high turbidity or dark conditions. The cooling water will then pass through drum screens designed to prevent trash and weed from entering the cooling water circuit.

In comparison with 8 other coastal and estuary based power stations around the UK and French coasts, the mass of fish entrained at Kingsnorth power station has been reported as relatively low[2]. Thus, Kingsnorth was reported to have the lowest mass of fish entrained per unit volume of water at around 4.4 kg per 10^6 m^3 compared with an average of 53 kg per 10^6 m^3 at the other stations (range 5-190 kg per 10^6 m^3).

The above assumes that the lower total output and more efficient units would not be able to utilise a lower flow rate to discharge its reduced thermal load to the estuary. This is unlikely to be the case in reality, not least because there is a commercial incentive to reduce flow rates and hence pumping costs. With reduced intake velocities and volumes for a new, more efficient units, it is suggested that the mass of fish entrained will be reduced.

Discharge.

Section 3.2 gives details of the modelling studies for the thermal plume from the cooling water discharge

The proposed cooling water discharge and heat loading from the proposed power plant is considerably lower than that currently consented. If the same CW flow is assumed (64.8 m^3s^{-1}) the temperature of the discharge from units 5&6 would be up to +6.7°C compared to the existing consented level of 18°C.

There will be some need for biofouling control during summer months to protect the cooling water system. This is discussed in Section 3.2.4.5 of this Environmental

Statement. No significant change will result from operation of Units 5 & 6 compared with existing operations.

Thermal discharges can result in a range of direct and indirect effects on the receiving environment. These can include; lethal and sub-lethal responses from organisms; stimulation in productivity; and reduction in dissolved oxygen concentrations. Long-term temperature rise also increases the risk of the establishment of non-native species, which may have a competitive advantage over native species as a result of the warmer temperature.

There are no statutory water quality standards for temperature that apply in the estuarine waters. However, as discussed in Section 3.2.2, the Water Quality Technical Advisory Group (WQTAG) have recently issued guidance on the assessment of thermal discharges on 'European marine sites' (WQTAG 160). The standards given are shown in Table 3.2.2

The Medway Estuary and Marshes is designated as an SPA and hence the applicable thresholds ar 2°C deviation from ambient at the edge of a permitted mixing zone and 28°C as a 98 percentile maximum temperature, again at the edge of the mixing zone. Section 3.2.4 models the extent of this mixing zone in the Medway estuary for the proposed development.

A mixing zone is acceptable if it can be demonstrated that it will not have an adverse effect on site integrity. A number of generic considerations are given by WQTAG that apply to assessments on site integrity, which are expanded below for the assessment of thermal discharges.

i. Spatial considerations:

Migratory fish species will be an important element of estuarine habitat structure and functioning, and may even be cited as specific interest features in their own right. They require a significant "window of opportunity" to migrate upstream. The mixing zone is likely to be surface-biased but should not form a barrier to migration across the whole estuary, or block areas of the estuary through which fish are known to pass.

(*The data form for the Medway Estuary and Marshes SPA does not reference the importance of migratory fish species for the structure and functioning of this site and they are not cited as special interest feature. In any case modelling indicates that a barrier to migration is not formed as the thermal plume does not extend across the estuary to full depth at any tide)*

ii. Natural thermal regime:

Estuaries are highly changeable environments and temperatures will fluctuate on a daily basis due to tidal and solar influences, as well as over a seasonal cycle. Most UK estuaries can reach a water temperature in excess of 20°C in late summer when sea temperatures are highest. Intertidal surfaces will get much hotter than this (>30°C) when exposed to the summer sun. If the temperature of the estuary naturally approaches the maximum temperature threshold, the impact of the mixing zone should be considered in relation to the natural conditions. It is important to note, however, that while estuarine organisms clearly survive at temperatures as high as the maximum daily or annual temperature recorded, survival is likely to depend on the duration of the high temperature being short and followed by lower temperatures.

Therefore the discharge should not prolong the duration of the maximum natural temperature to a degree which would begin to have negative impacts on the biota.

iii. Temporal variations:

It will be necessary to examine the impact of the mixing zone during "worst case" conditions. This will usually be in summer on neap tides, under low river flow conditions when dilution of the plume is lowest.

There should be particular consideration of temporal effects if the estuary is designated for migratory fish species, since the impact of any mixing zone will be more pronounced during periods of fish migration.

(Worst case conditions for mixing have been modelled in Section 3.2.4. The Medway Estuary is not designated for migratory fish species and in any case modelling indicates an unaffected pathway for migratory fish at all times).

iv. In combination effects:

Where more than one thermal discharge impacts upon the site, the additive spatial and temporal effects of any associate mixing zones should be considered. It will also be necessary to consider whether the combined effects of multiple discharges would cause a significant increase in background temperature.

(*The modelling studies in Section 3.2.4 consider in combination effects with other thermal discharges to the estuary.)*

Taking the above factors into consideration, the cooling water discharge impacts on fish populations would therefore be anticipated to be no significant threat to the integrity of the existing populations within the Medway Estuary and Marshes SPA and indeed impacts will be lower than for the existing power station.

The thermal discharge will have an effect on benthic organisms impacted by the cooling water plume. These are of particular relevance to the conservation importance of the estuary as they form the food source for the bird populations that use the mudflats. In addition to the modelling studies and reference to the WQTAG threshold values, there have been previous studies of the actual impacts of the discharge from Kingsnorth power station on the benthic communities in the Medway[4]. The discharge comprises a 4km long creek system (Damhead Creek). This reduces the speed of dilution of the thermal plume and hence sampling enabled a comparison of benthic communities subject to conditions varying from the undiluted discharge to control sites further away from the discharge. At the time of the study Kingsnorth power station was operating at a high load factor and included summer dosing with chlorine (at a nominal 1 mg l^{-1} at the point of dosing). The discharge was 68 m^3 s^{-1} at an average of 9.2°C above ambient temperatures (compared with the maximum of +6.7°C for the proposed plant at the same flow rate). The fauna in the discharge canal (at incremental sea bed temperatures in the range +1.3-7.6°C) had a lower diversity of species. The species most conspicuously eliminated from the creek were those with calcareous shells. While the number of species was lower within the discharge canal, abundance was found to be consistently higher (up to 80,000 m^{-2} compared to a maximum of 12,190 m^{-2} at the control site).

[4] Bamber, RN & Spencer JF 1984. The benthos of a coastal power station thermal discharge canal

The proposed new units would discharge through the same discharge channel and consequently impacts will be similar to those found during this survey, albeit of lower magnitude due to the smaller thermal loading produced.

The differences in species composition of benthic fauna could potentially affect the quality as a food source for bird and fish populations that may be selective feeders. Damhead Creek is designated as a bass nursery area as it harbours large numbers of bass that favour warm waters. This population is clearly healthy and not subject to limitations of available food supply. Large numbers of waterfowl still use Damhead Creek during the winter months. In cold weather their numbers can peak at over 2000 ducks, mainly wigeon and teal but with smaller numbers of mallard, shoveler and gadwall.

At low water the mudflats of the creek are used by waders, with around 1,500 lapwing and smaller numbers of curlew, grey plover, redshank, greenshank, black-tailed godwit and oystercatchers present. The greenshank use the salt-marsh edge for a high tide roost with up to 150 in the flock. Appendix D2 includes some relevant bird count data relating to this area of the estuary. Average bird densities and range of species around Damhead Creek appear generally comparable with average bird densities and range of species recorded across the rest of the Medway estuary (bearing in mind the small proportion and hence range of habitats present within this small part of the Medway). It would therefore appear that from observations within the Medway Estuary that power station thermal plumes, even when of greater intensity than would occur with the new supercritical units discharge, do not in practice have a significant adverse impact on the bird populations.

Thus it is predicted that the impacts on the benthic fauna at the discharge from Kingsnorth units 5 & 6 (as with the existing power plant impacts) in comparison to unaffected sites will be limited to some possible variation in the species composition over a limited area in Damhead Creek, but that abundance will not be adversely affected. The benthic fauna in the area is not thought to harbour species of particular conservation interest per se, but that the main importance is as a food resource for fish and bird species. No adverse significant effect on birds through food availability/quality impacts is evident in this area.

Mitigation Measures

Mitigation measures have generally been considered as inherent in the design process. Thus the proposed new units are intended to utilise supercritical boiler technology that is more efficient than the existing units and hence will reject less heat into the cooling water system. The proposed new units will use coal as the primary fuel, and combined with up-to-date emissions control technologies, will result in low emissions of NOx and SO_2. This will minimise off-site impacts through air pollution and deposition of acid gases, etc. The re-use of existing cooling water structures, will also minimise the production of waste materials and disturbance from construction activities.

The layout of the proposed development uses existing industrial areas, which have negligible ecological value. It will also utilise existing facilities on site, such as cooling water systems, access roads etc. which minimises construction requirements and associated disturbance to wildlife, particularly in the Medway estuary. In order to further reduce any ecological impacts, the following features have been incorporated into the development design:

- An integrated reptile and amphibian mitigation strategy, based on reasonable avoidance measures to minimise damage to populations on site, will be produced and implemented in consultation with Natural England.
- Good housekeeping practices will be adopted to reduce risk of pollution and minimise impacts of construction work disturbance on other wildlife. Site staff will receive specific briefings when working adjacent to more sensitive receptors, such as saltmarsh and drains, so that particular care is taken with work practices. However in this project the need for any works in close proximity to such sensitive receptors is considered to be minimal.
- Any topsoil and subsoil moved during construction will be stored separately
- Construction activities will need to avoid disturbance of any bird nesting sites, particularly black redstarts.
- A full time Environmental Initiatives Officer is employed by E.ON UK who covers both the Kingsnorth and Grain power station sites and promotes opportunities for conservation and will ensure that impacts through construction and operation are minimised

Summary and Conclusions

- The proposed units 5 & 6 at Kingsnorth power station site are to be located in an industrial area with some hardstanding and of low ecological importance. However the site neighbours land designated as an SSSI / SPA / Wetland of International Importance.
- The ecological studies for the proposed development included desk reviews of previous studies, Phase 1 Habitat Surveys on land to be affected by development, and bird records obtained from the Environmental Initiatives Officer and WeBS and reptile, amphibian, mammal and bird surveys.
- Consultations took place with interested parties including Natural England and other interest groups to ensure their concerns were addressed by the studies.
- The proposed new units will be constructed on habitat which may be described as ‘industrial’ in character. The majority of species identified in these areas are relatively common.
- The power station buildings have been used as breeding sites by black redstarts. The range of habitats available to this species will remain as at present, so no loss of suitability would be expected during operations. Care will be taken to avoid disturbance or damage to any nests during construction.
- Data has been presented on the birdlife of the Medway Estuary. However, the existing buildings and sea defence barrier form an effective screen for most on-site activity. Therefore, there are not predicted to be significant development impacts on birds, nor will the ecological integrity of the SSSI site be compromised by the development.
- Water velocities at the intake are calculated to be relatively low (8 -21 cm s^{-1}) due to use of cooling water headworks designed for operation at greater flow rates than is required by the lower total output and more efficient new units. This should allow fish to avoid entrainment effectively under most conditions.
- Operation of the new units will generate a warm water discharge that will maintain the suitability of the area as a nursery area for bass (the power station outfall is a designated fishery exclusion zone)
- Modelling of the thermal plume indicates a relatively restricted area of impact that does not extend across the estuary on any state of tide. This will permit unrestricted movements of any fish that might possibly be affected by a thermal plume.

- The abundance of benthic invertebrates, that act as a food source for fish and bird populations, are predicted not to be reduced by the operation of the power plant.

3.6 Landscape and visual effects

3.6.1 Introduction

Scott Wilson has been appointed by E-ON to carry out a landscape and visual impact assessment for the proposed extension of the existing coal-fired power station at Kingsnorth, North Kent.

This chapter presents the assessment of the effects of the development of Units 5 and 6 as an extension of the existing power station, referred to as 'the development', upon the landscape and visual receptors' views of that landscape. The chapter comprises:

- summary of the methodology used in the assessment;
- details of the development proposal pertaining to potential landscape and visual effects;
- description and analysis of the existing landscape and visual baseline; and
- description of the impacts and assessment of the effects of the proposed development on the landscape and on visual receptors.

This chapter considers direct and indirect impacts of the development and the cumulative effects with the existing Kingsnorth power station Units 1 to 4 using the following scenarios:

- Baseline (2006);
- Construction of the Units 5-6 (2008 to 2012);
- Day of Opening of Units 5-6 (2012 with Units 1-4);
- Demolition of Units 1-4 (2013 to 2014 with Units 5-6);
- Future Baseline, no development (2027); and
- Future Development of Units 5-6 (2027).

The timescale for the construction of the development allows for a four year construction period including a 12 month period for the commissioning of the new units. On operation of the development there will be a two year period for the decommissioning and demolition of the existing units.

Although demolition of the existing Units 1-4 is not included within the scope of this application for construction of the new units, it is appropriate to consider the future long term visual appearance of the new units when the existing units have been demolished. This scenario has therefore been included.

3.6.2 Methodology

The methodology used for the Landscape and Visual Impact Assessment is described in detail in Appendix C1. It is primarily based on the revised guidelines for Landscape and Visual Impact Assessment published by the Landscape Institute and Institute for Environmental Assessment, 2002.

The assessment is based on information gathered through desk studies and field survey work, concerning the physical, human and aesthetic factors influencing the character of the landscape.

The following documents have been used in the preparation of this report:

- Countryside Character, Volume 7: South East & London published by the Countryside Agency;
- The Landscape Assessment of Kent 2004 prepared by Jacobs Babtie, published by Kent Council;
- Kent and Medway Structure Plan Adopted Version 2006; and
- The Medway Local Plan Adoption Version 2003.

The visual assessment identifies a range of potential key visual receptors that will sustain some degree of effect as a result of the development (see Appendix C2). Eight viewpoints have been selected. These viewpoints were selected and agreed in consultation with the Planning Department of Medway Council as part of a previous application for a proposed FGD plant on land at Kingsnorth power station. In addition, an indicative Zone of Visual Influence (ZVI) has been identified in order to show the possible extent of visibility of the existing power station and the proposed development. Photomontage impressions have been prepared to illustrate the visual impacts on key representative views.

3.6.3 Baseline Studies

3.6.3.1 Landscape Context

The site for of the proposed development is located in the southern part of the Hoo Peninsula in North Kent. The site is situated within the Medway district approximately 3km to the east of the village of Hoo St. Werburgh and approximately 9km to the west of the Isle of Grain, where a number of other large scale industrial works can be found including the Grain power station, oil refineries and a large container terminal complex.

The boundaries to the site are well defined by an industrial estate to the north comprising of large scale units and Damhead Creek power station, building edges and scrub/grassland to the west, Units 1 to 4 of the existing Kingsnorth power station, the River Medway to the south, and Damhead Creek to the east. The site for the proposed development is approximately 32.9 hectares in size including areas to be utilised for construction and lies immediately north of the existing Units, which consists of a number of large buildings and structures, principally the boiler house (71 m high) and chimney (198 m high).

3.6.3.2 Landscape Planning Context

The Kent and Medway Structure Plan adopted in July 2006 was reviewed and contains a policy relating to the protection of Kent's coast and estuaries, Special Landscape Areas and trees, woodland and hedgerows that may be relevant to part of the site. The Kent and Medway Structure Plan and the Medway Local Plan exclude the site of the Kingsnorth power station from any specific landscape designations. The policy relevant to trees and woodlands aims to safeguard and enhance existing vegetation cover.

The North Kent Marshes can be found immediately to the east of the Kingsnorth power station boundary. The designation recognises the natural beauty of this area with the aim of safeguarding its character. However, developments of countywide significance will be considered. The coastline forming the southern and western boundary of the site has been designated as developed coast , which permits development if it is not detrimental in respect of appearance, coastal erosion and public access. However, the coastline adjacent to the east and west of the power station has been designated as undeveloped coast. This designation aims to safeguard the scenic and heritage value of the landscape and to increase public accessibility where appropriate. Full policy descriptions are contained in Table 3.6.1.

Table 3.6.1: Landscape Planning Policy Descriptions

Kent and Medway Structure Plan Adopted Version 2006	
Reference	*Policy*
EN2	Protecting Kent's Coast and Estuaries *"Kent's undeveloped coast and estuaries will be protected, conserved and enhanced. Development in such areas and in adjoining countryside will not be permitted if it materially detracts from the scenic, heritage, wildlife or scientific value of these areas. Development so permitted should include appropriate mitigation and/or compensation."*
EN5	Special Landscape Areas *"Special Landscape Areas are defined as follows and indicated on the Key Diagram. Detailed boundaries of the SLA's will be reviewed and defined in Local Plans/Local Development Documents:* *North Kent Marshes* *The primary objective of designating Special Landscape Areas is the protection, conservation and enhancement of the quality of their landscapes, whilst having regard to the need to facilitate the social and economic well-being of the communities."*
EN9	Trees, Woodland and Hedgerows *"Tree cover and the hedgerow network should be maintained. Additionally, they should be enhanced where this would improve the landscape, biodiversity, or link existing woodland habitats".*
The Medway Local Plan Adoption Version 2003	
Reference	*Policy*
BNE33	North Kent Marshes – Special Landscape Areas (SLA) *Development within the North Downs and the North Kent Marshes special landscape areas, as defined on the proposals map, will only be permitted if:* *(i) it conserves and enhances the natural beauty of the area's landscape; or* *(ii) the economic or social benefits are so important that they outweigh the county priority to conserve the natural beauty of the area's landscape.*
BNE45	Developed Coast *Development will be permitted in and alongside the undeveloped coast, as defined on the proposals map, only if:* *(i) a coastal location is essential and no suitable alternative site exists along the*

	developed coast; and *(ii) the scenic, heritage or scientific value of the undeveloped coast is maintained and, where consistent with this and where practicable, public access to the coast is improved; and* *(iii) the development is not likely to be at risk from flooding or coastal erosion to the extent that it would require defence works for its safety and protection*
BNE46	Undeveloped Coast *Development will be permitted in and alongside the developed coast, as defined on the proposals map, when:* *(i) the appearance and environment of the coast is improved; and* *(ii) coastal erosion will not threaten any new building proposed as part of the development; and* *(iii) public access to the coast is improved, where practicable and whenever appropriate; and* *(iii) the need for the coastal location is justified when the development is outside existing settlement boundaries and Economic Development Areas.*

3.6.3.3 Landscape Character

The development site is located at the interface between the character areas of the *Greater Thames Estuary* and the *North Kent Plain* as identified by the Countryside Agency. The landscape of the River Medway estuary is predominantly flat, open and low-lying, consisting of marshlands, mudflats, arable fields and traditional unimproved wet pasture. There is sparse tree cover with widely dispersed settlements. Water and sky are ever-present and dominate views. Post-war development has given rise to a large number of industrial buildings and complexes. The scale and constant visual presence of such large structures has resulted in them becoming characteristic of the area and they now act as visual reference points.

Towards the north and north-west of the development site, the arable and horticultural fields of the North Kent Plain provide a gently undulating landscape which contrasts with the coastal estuary. Although hedgerows and trees are sparse in general, discrete but significant areas of woodland and orchards can be found on higher ground, determining a less open landscape character. Refer to Figure 1.

The Landscape Assessment of Kent (2004) prepared by Jacobs Babtie for Kent Council sub-divides the above character areas into the Hoo Pennisula, Medway Marshes and Capstone Downs.

The landscape pattern within the Hoo Pennisula is incoherent and open, with large-scale industrial developments creating visual detractors in the landscape. The landscape of the Medway Marshes character area is low-lying, flat with open skies and extensive views. To the north the isolated industrial complexes of Grain and Kingsnorth dominate the Marshes. The landscape character of the site and immediate setting is considered to be of low sensitivity.

3.6.3.4 Topography and Natural Drainage

To the south of the site are the waters of the River Medway and to the west, Damhead Creek. Further south of the River Medway, near Chatham and Gillingham, the rolling hills of the North Downs rise to over 100m AOD, offering occasional long views north across the Medway towards the Hoo Peninsula. Lying north-east the Isle of Grain consists predominantly of flat and low lying marshland and mudflats. The land gently undulates. However a low ridge to the north of the site rises to approximately 40m AOD. The site of the proposed development generally lies at approximately 5m AOD.

3.6.3.5 Vegetation Cover

The surrounding areas of the site are characterised by both farmland and marshland. The low-lying areas of the estuary are open salt marshes, parts of which have been drained and reclaimed and are now used for grazing sheep and cattle. A mixture of saltings and mudflats can be found beyond the sea walls and dykes. The higher lying areas are used for arable farming. Hedgerows are scattered along the boundaries of the large, rectangular fields and trees are limited to small woodland plantations, farmsteads and dwellings on the higher ground.

The proposed development site is largely covered with meadow grassland, remnant field hedges and scattered scrub. In the past the area has been leased for hay cutting. A larger area of grassland to the west is divided into smaller fields with post and wire fencing. Along these lines there is evidence of vegetated field boundaries, post and wire fencing with sparse cover of mainly mature hawthorn. An area of tall grasses and scrub lies to the most easterly part of the site, which is un-maintained and has been left to grow fallow. The site is surrounded on all sides by a flood defence bund that provides low level screening to the Damhead Creek power station to the north.

To the west of the site a number of fenced areas contain woodland and scrub planting with areas of tall and short grassland. An area to the north-west is maintained as a nature conservation site. An area of land currently used for industrial purposes lies 350m to the north of the site.

The existing landscape features on the development site and areas to the west are considered to be of medium sensitivity with the nature reserve being medium to high sensitivity.

3.6.3.6 Settlement and Land Use

The Thames and Medway Marshes have been subject to the sometimes visually chaotic growth of various major developments including ports, mineral extraction, power stations and other industrial activities. There is no clear characteristic settlement pattern or building style identifiable, probably because much of the development has taken place over the last 50 years. However, there is evidence of early human activity in the Medway and Thames estuary. This historical character is visible, for example, in the existence or two forts, Hoo Fort and Darnet Fort, both of which can still be found on islands in the Medway estuary approximately 500m from the site.

The surroundings of the development site are characterised by villages and farmsteads on higher ground within and on the edge of the marshes. However, industry, housing, caravan sites, transport routes and other structures occupy some highly visible sites within the low-lying marshes. The road network in the surrounding area combines busy major trunk roads such as the A228, and quieter country lanes.

3.6.3.7 Recreation and Public Rights of Way

Local recreation facilities predominantly comprise of playing fields, marinas, The Strand and Sharp's Green Riverside Country Park at the southern bank of the river.

There is an extensive network of public rights of ways in the wider and immediate surroundings of the proposed development site. The primary footpath is the Saxon Shore Way, a National Trail, which runs along both the northern and the southern banks of the River Medway. Upon the northern bank the route divides into two courses, one running along the coast line and the other running parallel approximately 4km above. The courses reunite and the Saxon Shore way continues approximately 35km north until it meets the A228 trunk road. Many secondary footpaths link from Saxon Shore Way. The existing high rising structures of Kingsnorth power station are highly visible from many of these surrounding footpaths.

3.6.4 Visual Baseline Conditions

3.6.4.1 Zone of Visual Influence

The Zone of Visual Influence of the proposed development is shown in Figure 2. The ZVI covers an area of approx. 80 km² and is defined to the north and west by the rising ground of the *North Kent Plain* and to the south by the built up area and rolling hills of the North Downs. The eastern boundary of the ZVI is difficult to define due to the flat, open topography, but it is likely to reach as far as Sheerness. (Note that the identified ZVI is indicative and it is likely that views from elevated receptors located further afield may exist. The significance of any such views, however, would be low due to the long distance of over nine kilometres.)

3.6.4.2 Viewpoints

Views from key visual receptors have been identified within the ZVI and are scheduled and assessed in detail in Appendix C2. The location of viewpoints illustrated by photomontage impressions and photographs is shown in Figure 3.6.3. As many visual receptors share similar views of the power station and in order to avoid repetition, individual visual receptors have been grouped together where geographically appropriate and are as follows:

- views from the south: receptors at the south side of the River Medway;
- views from the west: residents of Hoo St. Werburgh, Hoo Marina and users of public rights of way to the west of the power station;
- views from the north: isolated settlements and farmsteads to the north of the site;
- views from the north east: Stoke, Middle Stoke and Lower Stoke and Stoke Marshes; and
- motorists on the road network between Hoo St. Werburgh and the Isle of Grain.

Views from the south - receptors at the south side of the River Medway
Visual receptors have been identified on the southern bank of the River Medway, an area characterised by the built environment of Chatham and Gillingham. Key visual receptors to the south include users of the Saxon Shore Way and its associated facilities, residents and motorist using the A289. The Saxon Shore Way runs along the riverbank and provides distant but uninterrupted views towards the existing power station at Kingsnorth. At various points along the route its visual sensitivity is increased by the presence of visitor facilities such as the Strand and Country Park near Rainham. In addition, motorists using the A289 have a prominent but temporary view to the existing power station when driving northbound towards the banks of the River Medway.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
Visual receptors viewing the development from the west comprise residents of Hoo St. Werburgh, Hoo Marina, residents of the new housing complexes of St. Mary's Island and users of the footpath network west of the site. These receptors gain clear or partially screened views of the power station set in the context of wide panoramic views of other developments on the Isle of Grain.

Close views from the north: Isolated settlements and farmsteads to the north of the site
A number of dispersed settlements and small hamlets are located to the north of the site. Residents in this area have clear views of the two existing power stations and associated industrial estate.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
Views from Stoke are limited to those from the southern edge of the village and from the top floors of houses. Views from Lower Stoke and Middle Stoke are even more limited as the two hamlets are located on lower ground than Stoke. Residents and walkers on the footpaths in this area view the power stations and industrial works from the northeast. These views are wide, panoramic, long distance and include the industrial areas of Grain and Kingsnorth.

Users of the road network between Hoo St. Werburgh and Isle of Grain
Motorists in this area have prominent and sometimes partially screened views of the power station.

3.6.5 The Development Proposal

The proposed development comprises of an arrangement of buildings and structures of varying heights and shapes that will relate to the operational requirements of the proposed Units 5 and 6. Two symmetrical boiler and chimney structures are the tallest and most dominating structures. The development will be located on an area of existing rough grassland directly to the north of the existing Units. In respect of landscape and visual issues, the main components of the proposed development are detailed in Table 3.6.2 with their anticipated heights.

Table 3.6.2: Components of the Power Station Development

Description	Height m
Unit transformers	8
Turbine hall	38
Boiler	110
Precipitators	31
FGD absorber	36
Stack	198
Air re-heater	36
FGD services building	15
Limestone mills & electrical plant	20
Gypsum dewatering building	26
Limestone silo	35
Gypsum silo	35
Ash silos	35
Limestone slurry storage tanks	15
Oil storage tanks	16
Black start facility	13
Black start stacks	40
Station services buildings	10
Desalination plant	10
Water storage tanks	15
Stores building	10
Sub station	15

A conveyor will transport coal from the existing stockyard, located to the south east, by two different junction towers at heights of 15 and 33.5 metres to enter the boiler house at a height of 60 metres. Other structures included in the proposal are at a height of 7.5m or less. All structures and buildings will be of a non-reflective pale grey finish.

3.6.6 Landscape Effects

Construction of Units 5-6 (2008 to 2012)

The proposed development is to be constructed on areas of meadow grassland that are divided into smaller fields with lines of redundant hedgerow with mature hawthorn. A total area of 17.47 hectares of meadow grassland, 3.73 hectares of rough grassland and approximately 224 linear metres of fencing with scattered hedgerow will be lost. As part of the construction process a number of areas to the west and an area to the north of the site will be utilised as temporary construction areas. Refer to Figure 2.1.1. As part of this process an area of 4.15 hectares of woodland and scrub, 3.74 hectares of grassland with scattered scrub, 2.31 hectares of concrete with scrub and regenerated birch and 293 liner metres of post and wire fencing with scattered mature hawthorn will be lost. The magnitude of impact upon the landscape features during construction is estimated to be high resulting in a Significant effect. Areas not being restored will result in a Significant permanent effect.

The site and its local setting are very typical of the landscape character as identified by the Countryside Agency of industrial buildings and complexes that are now characteristic of the area. The development, a coal fired power station, is in keeping with the existing character of the site and surrounding area.

The construction of the development is considered to have a high magnitude of landscape impact due to the large scale of the development. However the nature of the construction activity will not largely differ from the existing surrounding landscape, of large-scale industrial installations. This assessment is based on the premise that there will be two coal-fired or oil-fired power stations in the local area. Impacts upon the landscape character during construction would be Significant but temporary.

Day of opening of Units 5-6 (2012 with Units 1-4)

Upon completion the development will have a medium impact on landscape features in the medium term. Laydown areas covering 7.97 hectares will be reverted back to woodland, grassland and scrub. The effect on landscape features would be Significant in the medium term.

The development will have a medium impact on landscape character in the medium term. Given the low sensitivity of the site, the effect on landscape character would be Insignificant.

Demolition of units 1-4 (2013 to 2014 with units 5-6)

No landscape features exist on the site covered by Units 1 to 4. Therefore there will be no impact on landscape features. Due to the permanent nature of the activity, removal of a large industrial feature and chimney from the landscape, there will be a beneficial effect on landscape character. Given the low sensitivity of the area, the effect on landscape character would be Insignificant.

Future Baseline, no development (2027)

Changes that are predicted to affect the character of the site as part of this scenario will be the demolition of Units 1-4 carried out as part of a separate application. The effect on landscape features will be beneficial with a magnitude of change predicted as medium. The significance of long-term effects in the absence of development is assessed to be slight beneficial.

Due to the permanent nature of the activity, removal of a large-scale industrial feature from the landscape, there will be a positive effect on landscape character. Given the low sensitivity of the area, the effect on landscape character would be Insignificant beneficial.

Future Development of Units 5-6 (2027)

The overall long-term effects on landscape assessed during the operation phase of the development in 2027 will be:

- the permanent loss of 13.74 hectares of meadow grassland;
- the permanent loss of 3.73hectares of rough grassland;
- the permanent loss of 4.15 hectares of woodland and scrub;
- the permanent loss of 3.73 hectares of rough grassland with scattered scrub;
- the permanent loss of 2.31 hectares of concrete with scrub and regenerated birch;
- the permanent loss of 507 linear metres of post and wire fencing containing scattered mature hawthorn;
- the creation of 7.97 hectares of species rich grassland with areas of scrub and woodland;
- the permanent change in land-use from grazed pasture to industrial; and
- a permanent change of site character.

Taking into account the change of land-use and landscape character the change is predicted as being of medium magnitude. At year 2027 the 7.97 hectares of species rich grassland and scrub will have established providing mitigation, which partially offsets the permanent removal of landscape features. The magnitude of change on landscape features is assessed to be low. The significance of long-term effects associated with the development on land-use and landscape character is assessed to be Insignificant. The significance of long-term effects associated with the development on landscape features is assessed to be Insignificant.

3.6.7 Visual Effects

The following paragraphs summarise the visual impacts of the development on different receptor groups identified in the visual baseline study and assesses the significance of the effects. The detailed assessment of the individual receptors is set out in Appendix C2. Appendix C2 determines the significance of visual effects as Severe, Moderate, Low or Negligible. Only those effects assessed in Appendix C2 as either Severe or Moderate are identified below as being Significant with effects assessed as Moderate/Low through to Negligible identified as being Insignificant. All effects are adverse unless otherwise stated.

Construction of the Units 5-6 (2008 to 2012)

Views from the south - receptors at the south side of the River Medway
Views of the construction of Units 5 and 6 will be partially screened by Units 1 to 4. In most cases, due to the visual impact during the construction phase, the change in views will be of medium magnitude of impact and the visual effect will be Significant.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
Units 5 and 6 will be located to the north of the existing power station. From this direction there are clear views of the new units and chimneys, which appear as a standalone development from to the existing station. Such views of the new units will be limited to a small number of locations around the eastern edge of Hoo St. Werburgh, the properties at the eastern most edge of the St. Mary's Island and recreation areas on St. Mary's Island.

The construction of Units 5 and 6 are most visible in views from the west and result in a medium to high magnitude of impact with the effects on visual receptors in this area being Significant. The majority of these views are from receptors with medium to high sensitivity.

Close views from the north: Isolated settlements and farmsteads to the north of the site
Residents in this area will have clear views of the development due to their relatively close proximity and high-level location. During the construction phase, the development will be partially screened by the existing Damhead Creek power station and the nearby industrial estate. Due to the nature of the activity resulting in a high magnitude of impact and the high sensitivity of the receptors the visual effect would be Significant.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
The construction of the proposed development will be viewed against the existing power stations increasing the visible mass of buildings and workings. Due to the sensitive nature of the receptors and the high to medium magnitude of impact the development will have a temporary but Significant effect.

Users of the footpath network of the Stoke Marshes will view the development from north-east resulting in a high magnitude of impact. The development will have a Significant effect during the construction phase.

Users of the road network between Hoo St. Werburgh and Isle of Grain
Motorists in this area have prominent views of the power station. The impact of the scale of activity, although temporary, will be of medium magnitude and as motorists are assessed as being of low sensitivity this will result in an Insignificant effect.

Day of Opening of Units 5-6 (2012 with Units 1-4)

Views from the south - receptors at the south side of the River Medway

To illustrate the impact of the development on receptors on this side of the river, a photomontage has been produced for the view from the Sharp's Green Country Park near Rainham (Figure 3.6.4 view 1B). In comparison to other visual receptors to the south, users of the river will have closer uninterrupted views of the proposed development.

Due to the scale of the development against the existing Units with its visually dominant buildings and chimneys the magnitude of change will be medium and the visual effect Significant.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
The development will be situated to the north of the existing power station buildings. The completed development appears as a separate group of buildings as viewed from this direction. Such views of the new units will be limited to a small number of locations around the eastern edge of Hoo St. Werburgh, the properties at the eastern most edge of the St. Mary's Island and recreation areas on St. Mary's Island (Refer to Figure 3.6.6, view 3B). Figure 3.6.5 view 2B shows the existing view in comparison with the predicted impact from the eastern edge of Hoo St. Werburgh. Figure 3.6.7 view 4B shows the existing view in comparison with the predicted impact from Saxon Shore Way. The magnitude of change from these receptors is assessed to be medium to high and results in a Significant impact.

Close views from the north: Isolated settlements and farmsteads to the north of the site
The completed development will appear as an addition to the existing power station, a closely knit grouping of three chimneys and a noticeable increase in the overall massing of the buildings. However, the structures associated with the development will appear behind the existing Damhead Creek power station and the adjacent industrial estate. The highly industrial surroundings and the dominance of the existing power station to the view provides a medium magnitude of change. As the receptors are considered to be highly sensitive, the visual effect would be Significant. The visual impact on residents of Tunbridge Hill is illustrated in Figure 3.6.8 view 5B.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
Residents and walkers on the footpaths in this area will view the development from the northeast. The proposed development will be viewed against the existing power station, increasing the visible mass of buildings. Even with the long distance from site and the dominance of the existing power station and other industrial structures within the view the magnitude of impact is assessed as medium. This results in the development having a Significant effect. Figure 3.6.9 view 6B illustrates the impact of the development on the residents of Stoke.

Users of the footpath network of the Stoke Marshes will view the development from north-east. The magnitude of impact of the development will be medium resulting in a Significant effect. (Figure 3.6.10 view 7B).

Users of the road network between Hoo St. Werburgh and Isle of Grain
Motorists in this area will have prominent views of the development. The magnitude of impact on road users will change depending on the stretch of road and the angle of view. The magnitude of impact on road users will be medium resulting in an Insignificant effect (see Figure 3.6.11 view 8B).

Demolition of Units 1-4 (2013 to 2014 with Units 5-6)

Views from the south - receptors at the south side of the River Medway
These receptors will have a clear view of the demolition site. Due to the temporary nature or the activity and the presence of Units 5 and 6 the magnitude of impact on receptors will be high resulting in a Significant visual effect.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
Views of the demolition site from this location range from clear uninterrupted views to those, which are locally screened. There will be a high to low magnitude of impact resulting in an overall Significant effect.

Close views from the north: Isolated settlements and farmsteads to the north of the site
Views for the north to the demolition site will be screened by the new Units and Damhead Creek power station. Due to the temporary nature of the activity the impact is assessed as medium to low resulting in an Insignificant effect.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
The demolition of Units 1 to 4 will be screened behind the new development. The activity is assessed as having a low magnitude of impact resulting in a Insignificant effect.

Users of the road network between Hoo St. Werburgh and Isle of Grain
Motorists in this area have partially screened views of the demolition site. The impact of the scale of activity will be of low magnitude and as motorists are assessed as being of low sensitivity this will result in an Insignificant effect.

Future Baseline, no development (2027)

Views from the south - receptors at the south side of the River Medway
The anticipated change from baseline in this scenario is the demolition of Units 1-4 and associated buildings. Due to the scale of change the magnitude of impact is assessed to be high with a Significant positive effect.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
Visual receptors will notice a high magnitude of change with the demolition of Units 1-4. The view will still contain a number of industrial features, including Damhead Creek power station. The removal of Kingsnorth power station from views in this direction is assessed to have a Significant positive effect.

Close views from the north: Isolated settlements and farmsteads to the north of the site
The removal of Units 1-4 as part of the existing structures associated with Kingsnorth will reduce the visible mass of industrial buildings. Damhead Creek power station and the mass of electricity pylons will become the most prominent features viewed from this location. The magnitude of change is assessed as medium resulting in a Significant positive effect.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
Residents and users of the public footpaths will experience the removal of Units 1-4 from the landscape with varying degrees, dependant on the angle of view and the remaining cluttered structures within that view. The magnitude of change is assessed as medium to high resulting in a Significant positive effect.

Users of the road network between Hoo St. Werburgh and Isle of Grain
At baseline 2006 the Units 1-4 are only just visible from these viewpoints. The removal of these structures from the view will have a low magnitude of change. Therefore it is assessed that there will be an slight positive effect.

Future Development of Units 5-6 (2027)

Views from the south - receptors at the south side of the River Medway
From the south of the River Medway at assessment year 2027 there will be prominent views of the proposed development, a series of tall structures and two chimneys, as a replacement to the previous Units 1 to 4. Units 5 and 6 will be located approximately 200 metres further north from the current station providing longer distance views from these receptors (Refer to Figure 3.6.4 view 1C). The magnitude of impact is assessed as low, resulting in an Insignificant effect.

Views from the west: Residents of Hoo St. Werburgh, Hoo Marina, St. Mary's Island and users of public rights of way to the west of the power station
At assessment year 2027 the views from the west will have a low magnitude of impact. The view contains a single mass of tall buildings dominating the skyline at both Baseline and Future Baseline (Refer to Figures 3.6.5, 3.6.6 and 3.6.7). The main change is that the location of the structures has moved further north and that there are two chimneys rather than one. From some views trees and shrubs that provide localised screening will have grown further in height. Therefore the visual effect is assessed to be Insignificant.

Close views from the north: Isolated settlements and farmsteads to the north of the site
Viewed from the north the mass of buildings has been reduced in size by the removal of Units 1-4 and associated structures. The development of buildings associated with the power station, are located closer to the receptors, increasing the prominence within the view (Refer to Figure 3.6.8 view 5C). The magnitude of change is predicted as medium and due to the sensitivity of the receptors the visual effect is assessed to be Insignificant.

Views from the NE: Stoke, Middle Stoke and Lower Stoke
From this location the development appears closer, as a mass of tall structures and chimneys. Due to the distance of the views the prominence of the development on the skyline is reduced (Refer to Figure 3.6.9 view 6C). Therefore the magnitude of change is predicted as low with an Insignificant effect on visual receptors.

Users of the road network between Hoo St. Werburgh and Isle of Grain
Motorists will not notice a change in their view of the development, due to the change in location (Refer to Figure 3.6.11 view 8C). The prominence of the development in the view will remain the same, due to the distance and the landform. The magnitude of change is assessed as low resulting in an Insignificant effect.

3.6.8 Landscape Mitigation

It is difficult to define the boundary between the design of the development and mitigation of visual effects as design and assessment are interactive and many 'mitigation measures' are imbedded in the original proposals. The design and layout of Units 5 and 6 are predominantly determined by operational requirements with limited scope for mitigation measures.

The following is recommended to mitigate the construction phase and potential long-term impacts on landscape and visual receptors:

- areas of woodland that abut road edges at the boundaries of the development site should be retained to provide a localised screening effect into the development during construction and operational phases;
- areas of grassland and scrub lost through the construction process will be re-established with appropriate species to the local area (refer to Ecology chapter); and
- the use of non-intrusive colours and non reflective materials.

3.6.9 Conclusion

The development is located at the interface of the Greater Thames Estuary and North Kent Plain character area, which are flat, open and low-lying, containing sparse tree cover with widely dispersed settlements. Industrial buildings and complexes dominate views and have become characteristic of the area.

Effects on the landscape

The proposed new units will be located on meadow and rough grassland to the north of the existing station Units with no loss of important landscape features. Landscape areas utilised for construction laydown will be replanted with appropriate tree, grassland and scrub species. The development is in keeping with the local landscape character of industrial buildings and complexes. The overall effects on landscape features have been assessed to be Insignificant in the long term due to the opportunity for replanting of these areas with tree, grassland and scrub planting. The overall effects on landscape character and land-use is assessed to be Insignificant.

Effects on visual receptors

During construction and at day of opening of the development, visual receptors from the west, north and north-east experience the greatest effect on visual amenity. The severe/moderate adverse effects are reduced to moderate/low adverse effects for the majority of receptors by year 15 of operation.

During the demolition of Units 1 to 4, receptors located in the south, nearest to these Units, will experience the greatest effect on visual amenity. Three groups of

receptors will experience a severe adverse effect in the short term reducing to moderate/low adverse effect in the long term.

By year 15 of operation, two groups of residential receptors viewing the site from the north will experience impacts of the greatest magnitude and significance. Their views are from higher ground, at relatively close proximity and the structures associated with Units 5 and 6 will be located closer to the receptors than the previous development. These receptors will experience a severe/moderate adverse effect on visual amenity in the long term.

The wider landscape of the development site is predominantly open and low-lying, with the effect of the proposal being widely visible. However the development, in the short term, is viewed against the existing power station Units 1 to 4. This increases the visibility of the power station resulting in a denser or more extensive mass of buildings with three chimneys instead of one. The proposed new units will amplify the visual intrusiveness of the station, increasing the effect on surrounding visual amenity. However, the increased effects on visual amenity in the short term are replaced by a minimal increase in effects on visual amenity in the long term. The decommissioning and demolition of the Units 1 to 4 will result in the new units dominating views in the long term.

3.7 Transport

3.7.1 Introduction

Scott Wilson was appointed by E.ON UK to carry out an assessment of the transport impact of the proposed new units of Kingsnorth power station. This chapter provides a summary of the methodology adopted, establishes the baseline, presents the development proposal and its transport characteristics, quantifies the traffic effects and identifies mitigation measures.

Discussions with Medway Council highways department have highlighted a number of issues which are set out below and which are considered in this report. The issues for consideration are as follows:

- a description of baseline conditions;
- calculation of peak development flows;
- distribution and assignment of construction traffic;
- network impact analysis;
- assessment of safety and capacity issues at sensitive points within the study area; and
- the formulation of mitigation measures.

The wider Study area has been identified in discussions with Medway Council to comprise the route from the M2 Junction 1, A289 Wainscott Bypass, Four Elms Roundabout, A228, Roper's Lane leading to the power station at Kingsnorth.

This chapter considers the traffic impact of the proposed development for the following scenarios:

- Baseline (2006);
- Peak of Construction (2010);
- Year of Opening (2012).

3.7.2 Proposed Methods of Transport

Consideration has been given to the most practical and economic methods of transport for the construction and operation of the new units.

Construction of the new units will require the delivery to site of a large amount of equipment and materials, including some large or abnormal loads. There will be a construction workforce, the size of which will vary throughout the construction period, which will have to travel to the site. Operation of the new units will require delivery of coal and limestone and despatch of gypsum and ash. There will also be deliveries of SCR reagent, water treatment plant additives and other consumable items. Operations and maintenance personnel will also travel to the site. The options for transport are by river, road or rail.

3.7.2.1 River transport

By far, the majority of coal burnt in power stations in the UK is now imported because of the limited production from UK mines. Even coal for the power stations close to UK mines (such as those in Nottinghamshire and Yorkshire) burn imported coal. Kingsnorth is an ideal site for imported coal with its purpose built jetty. There is the possibility of bringing Scottish coal into the jetty by boat, but currently this is not an economic option.

Therefore imported coal will be brought in by boat to Long Reach jetty as it currently is. It is also intended to deliver limestone for the new units by boat or barge to Long Reach jetty. Gypsum will also be exported by barge from Long Reach jetty.

Oil for use at Kingsnorth and Grain power stations is currently brought into Kingsnorth via Oakhamness jetty. The new units will require less oil than is currently used at Kingsnorth and Grain and this can be brought in via Long reach jetty. Once the existing units at Kingsnorth and Grain are de-commissioned, Oakhamness jetty would therefore not be required. E.ON UK will therefore be seeking views on what to do with the jetty in future.

As far as possible large loads will be brought in through the existing roll on – roll off facility on Long Reach jetty. This facility was used during construction of the existing units and its current viability has been demonstrated recently when a new large generator transformer was delivered to the site.

3.7.2.2 Rail transport

E.ON UK has investigated a rail link to the power station site from the nearby rail network a number of times including for this proposal. The following issues have been discovered:

For Coal Delivery

As stated above Kingsnorth currently burns imported coals which are best delivered by boat to Long Reach jetty. Alternatively boat deliveries could be brought into Thamesport/Grain and then brought to Kingsnorth by either road or rail. The following summarises the findings of the analysis into road or rail deliveries:

- Rail deliveries to Kingsnorth from the rest of the UK would be logistically complicated and expensive due to the distances and congestion of the rail routes.
- A connection to the nearby rail network has been assessed and found uneconomic compared to existing arrangements at Kingsnorth.
- The area where the rail junction would be located is known to be surrounded by a large amount of sensitive ecology.
- Road haulage from the rest of the UK would be uneconomic and unacceptable environmentally and even road deliveries from Thamesport/Grain would significantly increase local traffic and is not thought to be appropriate.
- Thamesport/Grain also has congestion relating to LNG vessel movement security that is forecast to increase and could adversely affect deliveries by boat.
- The rail link option is not viable and will not form part of this planning application.

- If it were to be pursued subsequently then a separate planning application would be made under the relevant legislation and the ecological assessments would be required for the required land area and route.

For other materials

- Limestone and gypsum – since rail has been found unsuitable for coal delivery (the largest materials movement for the site) it is therefore not appropriate to consider it at this stage for theser materials on the grounds of cost as compared to the alternative of river transport.
- SCR reagent, additives for the water treatment plant and other consumable items – with the relatively small quantities required it would not be economic for delivering these by rail compared to road deliveries.
- Ash – As discussed in Section 3.3 on solid wastes it is anticipated that many ash customers will be local to Kingsnorth. The diverse nature of these customers and their locations means that, in addition to being uneconomic, rail transport is not appropriate for export of ash.

For people

- the local line is a freight line and so not applicable to transportation of the workforce.

3.7.2.3 Road transport

The majority of construction materials will need to be delivered by road for logistical and economic reasons. As stated in Section 3.9 on socio-economics, it is expected that construction personnel will find accommodation in surrounding towns and villages, They will therefore travel to site by road, but contractual means will be used to minimise the number of cars and vans used and to maximise the use of communal transport in order to reduce the potential number of vehicles used.

Operational staff will live locally and will therefore travel by road. Deliveries of SCR reagent, water treatment plant additives and other consumable items will be delivered by road for logistical and economic reasons.

A detailed assessment of the implications of road transport has therefore been carried out.

3.7.3 Methodology for Assessment of Road Transport

The methodology adopted in this chapter to establish existing and future traffic conditions follows the guidelines set out in the 'Guidelines for Traffic Impact Assessment' published by the Institution of Highways and Transportation. The assessment of environmental impacts is assessed in line with the 'Guidelines for the Environmental Impact Assessment of Road Traffic' produced by the Institute of Environmental Assessment.

Best practice recommends that a scoping study is prepared in advance of the main assessment so that a dialogue can be established with the local highway authority to identify the main areas of concern and to agree a methodology for the assessment. A number of scoping studies have been agreed with the highway authority in the

recent past in the course of previous studies at both Kingsnorth and Grain power stations.

The main transport policy document prevalent within the study area is the Medway Local Transport Plan, 2006 – 2011 which has been referred to in order to establish the policy background.

3.7.4 Baseline Conditions

The study area is constrained to the route between the strategic network and the power station site. This links the M2 at Junction 1 with Kingsnorth via the A289 Wainscott Bypass, A228 and Roper's Lane. This is the designated route to the power station. The route by-passes the villages of Wainscott, Chattenden and Hoo St. Werburgh to reach the power station site at Kingsnorth.

General observations made on site are that Roper's Lane has a relatively light traffic flow with a high proportion of HGVs. Pedestrian activity is minimal. All side roads off Roper's Lane have a lorry weight restriction of 7.5 tonnes.

There is some frontage development at the junction of Roper's Lane and Stoke Road and a number of individual dwellings fronting the north side of Roper's Lane although these are set back from the road.

There are no footways on the entire length of Roper's Lane, although the road is crossed by the Saxon Shore Way foot path which doubles as a Bridleway.

Roper's Lane, from its junction with Stoke Road up to the A228 is a designated cycle way with signage of the cycle route mounted on the road.

The A228 has recently been subject to a major improvement scheme comprising the dualling of the A228 from the existing dual carriageway at Four Elms Hill to the existing roundabout at its junction with Roper's Lane. This construction was completed in 2004/2005.

The A289 Wainscott by-pass is a wide single carriageway with free flow slip roads at the M2/A2 and grade separated junctions along its length. The A289 terminates at the at-grade Four Elms roundabout.

Traffic flows on the designated route are based on counts supplied by Medway Council and by the Highways Agency for the Trunk Road network. Growth rates based on NRTF adjusted by TEMPRO for Medway District have been applied to bring the counts up to the required assessment years.

The flows for the baseline are as follows:

Weekday AM Peak Hour – 0800 to 0900

Location	2006 Base Two Way Flow
A289 Wainscott Bypass (East of Dillywood Lane)	3,983
A228 (East of Four Elms)	3,360
Roper's Lane	314

Weekday PM Peak Hour – 1700 to 1800

Location	2006 Base Two Way Flow
A289 Wainscott Bypass (East of Dillywood Lane)	3,415
A228 (East of Four Elms)	3,119
Roper's Lane	309

Weekday 24 Hour Flow

Location	2006 Base Two Way Flow
A289 Wainscott Bypass (East of Dillywood Lane)	34,157
A228 (East of Four Elms)	25,992
Roper's Lane	3,710

Future year flows are needed for 2010 (peak of construction) and 2012 (year of opening). Applying a growth factor to the 2006 base flows has derived future year flows. Industry standard methods of utilising NRTF growth rates and then fine tuning them with TEMPRO data has resulted in the following growth rates to be applied:

Conversion Factors to Derive Future Year Flows

2006 To:	Road Type	AM Peak	PM Peak	24 Hour
2010	Principal Dual	1.066	1.069	1.068
	Other	1.056	1.059	1.058
2012	Principal Dual	1.109	1.113	1.112
	Other	1.079	1.083	1.082

Committed developments have been assessed in detail in the study area corridor and many proposals are either programmed or planned. The biggest pressure within the immediate area is for the release of housing sites and proposals are advanced for housing sites at Elm Avenue, Chattenden, Bells Lane at Hoo St. Werberg and Highham Road/Wainscott Road at Wainscott. Other developments such as Grain CCGT power station, the BritNed interconnector and the LNG gas storage facility also need to be taken into account.

Medway Council have provided 2008 peak hour committed development flows that they regard to be realistic and robust and allow for the developments identified above. These flows are provided for the A289 and the A228 at Four Elms. These are reproduced below:

Committed Development Flows for 2008:

Link	AM Peak	PM Peak	24 Hour
A289	100	110	1800
A228	154	161	2144
Roper's Lane	0	0	0

These committed development flows will require slight uplift to represent 2010 and 2012 flows.

An additional committed development has recently been identified which will have a direct impact on Roper's Lane. Consent has recently been granted for an aggregates quarry and concrete batching plant on land immediately north of Kingsnorth power station. Traffic estimates presented with the application indicate a daily generation of 70 HGVs to/from the site. These will be distributed throughout the working day and it is reasonable to estimate that peak hour flows will equate to 7 inbound and 7 outbound HGVs.

3.7.5 The Development Proposal

The development proposal is to build units 5 and 6 of Kingsnorth power station. The build is programmed to start in March 2008 and will last for a period of 48 months.

The sequence of events that needs to be taken into account when calculating the build up of traffic at various times is as follows:

- The current consent for FGD to be fitted to Units 1 to 4 at Kingsnorth power station will be abandoned;
- Kingsnorth power station Units 1 to 4 will continue to operate until 2012;
- Kingsnorth biomass co-firing operation will continue to operate in the existing units until 2012.

The profile of workforce over the construction period has been estimated in consultation with a number of specialist power sector contractors with recent experience of large coal-fired power station construction. The information submitted by these contractors has been reviewed by E.ON UK and applied to this particular project. The resulting figures are regarded as robust. The profile of daily workforce over the 48-month construction period is shown below:

Profile of Daily Workforce Throughout Construction

Year of Construction	Month of Construction	Daily Workforce in The Month
2008	March	12
	April	15
	May	18
	June	24
	July	36
	August	57
	September	95
	October	147
	November	258
	December	376
2009	January	510
	February	645
	March	802
	April	864
	May	955
	June	1051
	July	1162
	August	1291
	September	1511
	October	1719
	November	1918
	December	2110
2010	January	2305
	February	2507
	March	2695
	April	2862
	May	3031
	June	3129
	July	3219
	August	3298
	September	3309
	October	3254
	November	3201
	December	3049
2011	January	2854
	February	2665
	March	2511
	April	2311
	May	2021
	June	1806
	July	1579
	August	1320
	September	1156
	October	1049
	November	984
	December	946
2012	January	763
	February	545

The peak of construction workforce is forecast to occur in September 2010 when 3309 workers are expected on site.

A number of abnormal loads are expected during construction. It is expected that the vast majority will arrive at site by sea and will utilise the roll on / roll off facility at the site.

3.7.6 Traffic Generation

With such a large workforce for the majority of the construction timetable, it is unrealistic to assume that the level of workforce needed can be drawn from a daily commutable catchment area. It is therefore expected that construction workers will live in accommodation in surrounding towns and villages within the development catchment area.

The working assumption is that 50% of the workforce will travel on communal transport to the development site. It is assumed the remainder will be drawn from a daily commutable catchment area.

When these assumptions are applied to the profile of daily workers, the following generation of communal transport and cars/vans results:

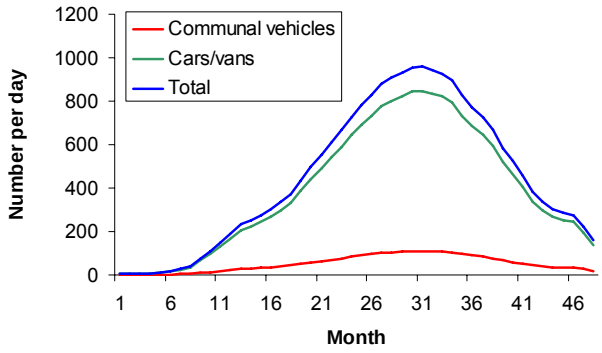
Generation of Vehicles during Construction

Month	Total Workers	50% by Communal Vehicles / 50% by Other	No. of Communal Vehicles	No. of Cars/Vans
1	12	6	0	3
2	15	7	0	4
3	18	9	1	5
4	24	12	1	6
5	36	18	1	9
6	57	29	2	15
7	95	48	3	25
8	147	73	5	37
9	258	129	9	66
10	376	188	13	96
11	510	255	17	131
12	645	323	22	166
13	802	401	27	206
14	864	432	29	222
15	955	478	32	245
16	1051	526	35	270
17	1162	581	39	298
18	1291	646	43	331
19	1511	755	50	387
20	1719	860	57	441
21	1918	959	64	492
22	2110	1055	70	541
23	2305	1152	77	591
24	2507	1254	84	643
25	2695	1347	90	691
26	2862	1431	95	734

Month	Total Workers	50% by Communal Vehicles / 50% by Other	No. of Communal Vehicles	No. of Cars/Vans
27	3031	1515	101	777
28	3129	1564	104	802
29	3219	1609	107	825
30	3298	1649	110	846
31	3309	1654	110	848
32	3254	1627	108	834
33	3201	1601	107	821
34	3049	1547	103	793
35	2854	1427	95	732
36	2665	1332	89	683
37	2511	1255	84	644
38	2311	1155	77	592
39	2021	1010	67	518
40	1806	903	60	463
41	1579	790	53	405
42	1320	660	44	338
43	1156	578	39	296
44	1049	525	35	269
45	984	492	33	252
46	946	473	32	243
47	763	383	26	196
48	545	273	18	140

Note: Communal vehicles occupancy based on 15 per vehicle
Car/Van occupancy based on 1.95 per vehicle

Indicative Workforce Vehicles



Examination of the table above reveals that the peak daily generation on this basis occurs in month 31 (September 2010) where 110 communal vehicles and 848 cars/vans will be generated. These vehicles will both enter and exit the site during the course of the working day.

It is also anticipated that the working hours will be long and will involve early starts and late finishes. Therefore the majority of the traffic generation associated with this development is going to occur outside the traditional network peak hours. It is expected that the following generations will occur:

- Hour beginning 0600 - 60% of daily inbound
- Hour beginning 0700 - 25% of daily inbound
- Hour beginning 0800 - 10% of daily inbound

- Hour beginning 1600 - 10% of daily outbound
- Hour beginning 1700 - 15% of daily outbound
- Hour beginning 1800 - 45% of daily outbound
- Hour beginning 1900 - 25% of daily outbound

The assignment of traffic to the network is made based on the geographic split of population within a 60-minute drive time of the construction site as detailed below. These assumptions have previously been agreed with Medway Council during the consideration of a previous scheme at the Kingsnorth site. The assignment of trips to the network is estimated as follows:

Assignment of Workers' Trips

Access Route	Catchment Area	Percentage of Catchment
Route 1 Via A2 or A226 onto A289 Wainscott Bypass, A228 and Roper's Lane	West London South Essex Dartford Gravesend	87%
Route 2 Via A228 or M2 onto A228 at M2 Junction 2, A228, Roper's Lane	South East London Sevenoaks Tunbridge Wells Maidstone Ashford Rochester	0% *
Route 3 Via A2 or M2 to A289, A289 (through tunnel), to A228, Roper's Lane	Canterbury Herne Bay Whitstable Faversham Sittingbourne Sheerness Gillingham	8%
Route 4 Via A228 (from north east), Roper's Lane	Hoo Peninsular Grain	5%

* People living in the areas listed are expected to approach the site primarily using route 1.

It is appropriate to only apply this assignment to the 50% of the workforce that will be arriving in cars and vans from the commutable catchment area.

The assignment of trips to the network for the peak month of construction taking account of the agreed assignment and the time at which traffic is expected to be generated results in the following two-way flows on the three links of interest:

Assignment of Car Trips at Peak of Construction based on 848 Cars

Hour Beginning	A289 87% of Flow		A228 95% of Flow		Roper's Lane 100% of Flow	
	In	Out	In	Out	In	Out
00:00	0	0	0	0	0	0
01:00	0	0	0	0	0	0
02:00	0	0	0	0	0	0
03:00	0	0	0	0	0	0
04:00	0	0	0	0	0	0
05:00	0	0	0	0	0	0
06:00	443	0	483	0	509	0
07:00	184	0	201	0	212	0
08:00	74	0	81	0	85	0
09:00	15	0	16	0	17	0
10:00	0	7	0	8	0	8
11:00	0	7	0	8	0	8
12:00	7	0	8	0	8	0
13:00	0	7	0	8	0	8
14:00	7	7	8	8	8	8
15:00	0	7	0	8	0	8
16:00	7	74	8	81	8	85
17:00	0	111	0	121	0	127
18:00	0	332	0	363	0	382
19:00	0	184	0	201	0	212
20:00	0	0	0	0	0	0
21:00	0	0	0	0	0	0
22:00	0	0	0	0	0	0
23:00	0	0	0	0	0	0

A number of workers' communal vehicles and HGVs will be generated throughout the construction period. The assignment of trips to the network for the peak month of construction taking account of the agreed assignment and the time at which traffic is expected to be generated results in the following two-way flows on the three links of interest:

Assignment of Communal Vehicle Trips at Peak of Construction

Hour Beginning	A289 100% of Flow		A228 100% of Flow		Roper's Lane 100% of Flow	
	In	Out	In	Out	In	Out
00:00	-	-	-	-	-	-
01:00	-	-	-	-	-	-
02:00	-	-	-	-	-	-
03:00	-	-	-	-	-	-
04:00	-	-	-	-	-	-
05:00	-	-	-	-	-	-
06:00	66	66	66	66	66	66
07:00	28	28	28	28	28	28
08:00	11	11	11	11	11	11
09:00	5	5	5	5	5	5
10:00	0	0	0	0	0	0
11:00	0	0	0	0	0	0
12:00	0	0	0	0	0	0
13:00	0	0	0	0	0	0

Hour Beginning	A289 100% of Flow		A228 100% of Flow		Roper's Lane 100% of Flow	
	In	Out	In	Out	In	Out
14:00	0	0	0	0	0	0
15:00	4	4	4	4	4	4
16:00	11	11	11	11	11	11
17:00	17	17	17	17	17	17
18:00	50	50	50	50	50	50
19:00	28	28	28	28	28	28
20:00	-	-	-	-	-	-
21:00	-	-	-	-	-	-
22:00	-	-	-	-	-	-
23:00	-	-	-	-	-	-

Assignment of HGV Trips at Peak of Construction

Hour Beginning	A289 100% of Flow		A228 100% of Flow		Roper's Lane 100% of Flow	
	In	Out	In	Out	In	Out
00:00	-	-	-	-	-	-
01:00	-	-	-	-	-	-
02:00	-	-	-	-	-	-
03:00	-	-	-	-	-	-
04:00	-	-	-	-	-	-
05:00	-	-	-	-	-	-
06:00	-	-	-	-	-	-
07:00	-	-	-	-	-	-
08:00	5	5	5	5	5	5
09:00	5	5	5	5	5	5
10:00	5	5	5	5	5	5
11:00	5	5	5	5	5	5
12:00	5	5	5	5	5	5
13:00	5	5	5	5	5	5
14:00	5	5	5	5	5	5
15:00	5	5	5	5	5	5
16:00	5	5	5	5	5	5
17:00	5	5	5	5	5	5
18:00	-	-	-	-	-	-
19:00	-	-	-	-	-	-
20:00	-	-	-	-	-	-
21:00	-	-	-	-	-	-
22:00	-	-	-	-	-	-
23:00	-	-	-	-	-	-

Transportation during operation

Once operational in 2012, Units 5 and 6 will be operated by a workforce of approximately 250 E.ON UK staff and permanent contractors working on a 3-shift basis (0700-1400; 1400-2200; 2200-0700). This is a similar number to the current operational staff and the vehicular movements will be similar to those currently occurring.

It is estimated that 3.9 million tonnes of coal per annum will be required to operate the new units. This coal will be delivered to site by boat which will utilise the existing jetty and conveyor facilities and some new conveyors that are to be provided as part of the development. This will require approximately 160 deliveries by boat each year. Co-firing of biomass in the new units has not been considered at this stage due to the uncertainty of legislation about this.

Units 5 and 6 will be fitted with FGD. The operation of this process will require 44.7 thousand tonnes of limestone per annum which will result in the production of 79.4 thousand tonnes of synthetic gypsum per annum. Both limestone and gypsum will be transported by boat utilising the jetty and conveyors. This will require approximately 6 boats for limestone and 10 boats for gypsum per year, Deliveries of these materials will not therefore have any impact on the local highway network. Only in very exceptional circumstances will road be used to transport these materials.

Deliveries of SCR reagent, water treatment plant additives and other consumable items will require approximately 300 lorries per year. Ash will be transported from site by road, requiring approximately 45 lorries per day.

3.7.7 Traffic Impact

Two specific issues of transport impact need to be examined to fully assess the development. Firstly, road capacity by comparing forecast base plus development flows against design capacity to ensure that the network can accommodate the combined level of traffic. Secondly, the percentage increase in flow at the peak of construction to assess the scale of impact.

Two scenarios have been identified for analysis comprising 2010 which represents the peak generation during construction and 2012 which represents the year of opening of the proposed development.

Base flows for 2010 and 2012 are identified below and have been calculated by applying the NRTF/TEMPRO growth factors identified above to the 2006 base flows, also identified above. Where appropriate, committed development flows are identified separately for clarity.

The forecast two-way flows compared to the design flows for each link on the designated route are compared below for the peak month of construction:

Design Capacity Check: AM Peak Hour

Link	TA79/99 Design Flow	Forecast 2010 Base plus Development	Within Capacity ?
A289 Wainscott Bypass	6,000	4502	YES
A228 (East of Four Elms)	5,333	3895	YES
Roper's Lane	2,166	463	YES

Design Capacity Check: PM Peak Hour

Link	TA79/99 Design Flow	Forecast 2010 Base plus Development	Within Capacity ?
A289 Wainscott Bypass	6,000	3956	YES
A228 (East of Four Elms)	5,333	3699	YES
Roper's Lane	2,166	512	YES

This analysis demonstrates that all links are forecast to operate below their design threshold.

The percentage impact that development flows add to base levels is used as a guide as to the general significance of a development. Daily variation in flow on the highway network can be anything upto 10% and this threshold is adopted as the threshold of materiality where an impact of below 10% would not be perceptible. A threshold of 5% is adopted in congested urban networks. The following tables identify the percentage impact caused by the development proposal at the peak of construction:

Percentage Impact: Weekday AM Peak - 0800 to 0900

Location	Peak Construction Month (September 2010)		% Impact
	Base Flow plus other	Units 5 and 6 Construction Traffic	
A289 Wainscott Bypass	4246 + 150	106	2.4%
A228 (East of Four Elms)	3582 + 200	113	2.9%
Roper's Lane	332 + 14	117	33.8%

Note: Unit 5&6 Construction traffic flow comprises cars/vans, HGVs and workers' communal vehicles.

Percentage Impact: Weekday PM Peak - 1700 to 1800

Location	Peak Construction Month (September 2010)		% Impact
	Base Flow plus other	Units 5 and 6 Construction Traffic	
A289 Wainscott Bypass	3651 + 150	155	4.0%
A228 (East of Four Elms)	3334 + 200	165	4.6%
Roper's Lane	327 + 14	171	50.0%

Note: Unit 5&6 Construction traffic flow comprises cars/vans, HGVs and workers' communal vehicles.

Percentage Impact: Weekday 24 Hour

Location	Peak Construction Month (September 2010)		% Impact
	Base Flow plus other	Units 5 and 6 Construction Traffic	
A289 Wainscott Bypass	36480 + 2500	2016	5.1%
A228 (East of Four Elms)	27759 + 3000	2152	6.9%
Roper's Lane	3925 + 70	2236	55.9%

Note: Unit 5&6 Construction traffic flow comprises cars/vans, HGVs and workers' communal vehicles.

The percentage impacts are greatest in the peak hours where development flows are concentrated and on the links with the lowest base flows. For example, Roper's Lane has a relatively low base flow due to the limited number of end users it serves. Conversely, the large increase in flow will be more perceptible where the base flows are currently low.

3.7.8 Analysis of Sensitive Environmental Receptors

From the detailed investigation of the study area, a number of potentially sensitive receptors and issues have been identified:

Location	Justification
Junction of Stoke Road/ Roper's Lane	The potential interaction between construction traffic and traffic from/ to Hoo St. Werburgh village via Stoke Road.
Sturdee Sports and Social Club	The potential interaction between construction traffic and Social Club traffic.
Roper's Lane approach to Junction with Stoke Road	HGV directional sign needs re-erecting and improving.
Roper's Lane	Poor road condition in places.
Nature Study Centre/ Adjacent to entrance to Power Station	The potential interaction between construction traffic and Nature Study Centre traffic.
Saxon Shore Way Long Distance Footpath crossing of Roper's Lane	Potential interaction of walkers/ pedestrians with construction traffic at point of crossing
Stoke Road – A228 designated cycle route.	Potential interaction between cyclists using designated route and construction traffic.

Junction of Roper's Lane and Stoke Road

In general terms, the geometry of the junction is standard. However Roper's Lane does bend sharply at this point. Advisory signs informing traffic of this are present together with chevrons on both approaches advising of the direction of the bend. The condition and visibility of these signs is poor and it is recommended they are improved or replaced.

Visibility splays and visibility of traffic advisory signs could be improved with maintenance of surrounding foliage.

Signage at the junction from the Stoke Road approach is comprehensive but the increase in traffic due to the construction may pose a threat to traffic joining Roper's Lane. Currently no sign is present advising motorists of high volumes of HGVs. It is recommended that a sign to this effect is erected.

Provision is made for non-motorised vehicles with footpaths for residents in nearby housing on Stoke Road. Roper's Lane northbound and Stoke Road are part of a designated cycle route, signage to this effect is present and no evidence exists that new facilities are required. Observed pedestrian, cyclist and equestrian activity was nil.

Traffic flows at the junction are relatively low and no capacity problems are envisaged at this junction.

Sturdee Sports and Social Club

The sports and social club is located on Roper's Lane adjacent to its junction with Stoke Road. It is the only identified trip generator other than the Nature Study Centre and is likely to attract visitors including children. As such its sensitivity needs to be highlighted.

Roper's Lane approach to junction with Stoke Road

A sign facing the Roper's Lane approach to Stoke Road is currently advising all Kingsnorth power station traffic to turn right. This is to avoid Stoke Road and ensure traffic follows the designated HGV route. However the sign is obstructed by foliage and is difficult to read. It is recommended the sign is replaced.

Nature Study Centre

The entrance to the power station is the continuation of Roper's Lane with a 25 mph speed restriction enforced by speed humps. The road forks off to the right providing access to the station's Nature Study Centre. This has been identified as a sensitive location as it is likely to generate trips other than those serving the power station itself. It is recommended that a sign advising traffic leaving the centre of HGV interaction.

3.7.9 Mitigation Measures

A number of mitigation measures have been incorporated into the analysis presented above. Each is briefly discussed below:

Formulation of a Transport Plan
It is intended that a condition of contract will require the contractors to prepare a travel plan. This will obligate the contractor to establish a network of journey to work site communal vehicles to transport construction workers between residential centres within the catchment area and the construction site throughout construction.

Use of Sea Transport
Once operational, the power station will generate the regular movement of large quantities of bulk goods in the form of coal, limestone and gypsum. These are to be transported by ship thus minimising the environmental impact of this part of the process.

Designated Advisory Route
A high quality designated route has been identified linking the power station site with the motorway network. The use of this route should be encouraged to minimise the effect that construction and operational traffic would have on less appropriate routes.

Highway Measures to Improve Highway Safety

A number of measures have been identified on site that would enhance highway safety associated with the construction of the power station as follows:

1. Improve or replace existing traffic advisory signs at and on approach to Roper's Lane junction with Stoke Road.

2. Maintenance of foliage at and approaching junction of Roper's Lane and Stoke Road.

3. Erection of sign to advise traffic from Stoke Road joining Roper's Lane of possible HGV interaction.

4. Replacement of routing sign for traffic associated with Kingsnorth power station.

5. Erection of sign to advise traffic from Nature Study Centre joining Roper's Lane of possible HGV interaction.

6. Construction workers should be briefed on access to the site before they commence work and encouraged to use the designated route to access and exit the site.

3.7.10 Conclusion

The proposal represents a large construction project and as such will employ a large number of people during construction and generate a large number of vehicle movements. Once operational, the development will generate flows that are comparable to the existing situation.

The principal transport impact occurs during the construction phase and particularly at the peak of construction in September 2010 when it is estimated that approximately 3300 workers will be present on site.

Mitigation measures have been identified to minimise the traffic and environmental impact of the construction and the analysis presented above is dependent on the mitigation measures being implemented.

There are no longer-term impacts once the development is operational.

3.8 Noise

3.8.1 Introduction

An important element of environmental quality is the audibility of industrial noise and other noise sources within a local community. The unit of noise measurement most commonly used is the overall 'A'-weighted sound pressure level in decibels, denoted dB(A). This unit provides a simple measure of the subjective human response to noise at various frequencies and has been found to provide the best overall correlation with the human response to various types of noise. The system of measurement is logarithmic rather than linear so that an increase or decrease of 10 dB(A) corresponds to a ten-fold increase or decrease in sound energy but only to an approximate doubling in perceived loudness. It is generally recognised that a change of 3 dB(A) is the smallest increase which is clearly noticeable, and that a 1 dB(A) increase would be on the limit of discernibility.

3.8.2 Environmental Noise Overview

In general measured noise levels close to a residential community are not steady, but are highly variable due to changes in traffic flow and the ebb and flow of domestic, commercial and industrial activity throughout the day and night. Typically, a diurnal noise pattern results with the lowest noise levels being reached during the night-time period. To cope with this variability environmental noise levels are usually measured as an L_{A90} dB level, where the L_{A90} means the level exceeded for 90% of the measurement period, and are measured separately during day, evening and night-time periods. The L_{A90} night-time level is thus expected to be close to the minimum measured noise level and is used to define the background noise level, as in British Standard BS 4142. In distinction the noise produced by industrial processes and its capacity to be audible is not set by the minimum noise level produced, but by the 'energy average' level, known as the L_{Aeq} or equivalent noise level. British Standard BS4142 relates the propensity for noise complaints to the difference between the pre-existing background noise level, measured as an L_{A90}, and the noise produced by the new source, measured as a L_{Aeq} noise level.

3.8.3 Assessment Approach

The methods contained in British Standard BS 4142 (1997) to assess the noise arising from new installations have been considered for this assessment. The British Standard shows that the most important factor is the amount by which a new noise, exceeds the background noise level and that an exceedance of the background level by 10dB(A), or higher, indicates that complaints are likely. An exceedance of approximately 5dB(A) is of 'marginal significance'. At differences below 5dB(A) there is a diminishing likelihood that complaints will occur. When the new noise level falls below the existing background level complaints become significantly less probable and at 10dB(A) below the background level complaints are positively unlikely.

Noise surveys have been undertaken at residential dwellings, or at positions representative of residential dwellings, and on the edge of communities which surround the proposed development. Noise measurements were undertaken in conditions of low wind speed, i.e. less than 3m/s, to ensure that there was no interference from aerodynamic noise, where possible. Particular emphasis was placed on night-time measurements, when ambient noise levels are generally low. This procedure results in the determination of the lowest background/ambient noise levels that are likely to occur.

To assess the significance of changes to environmental noise levels the Joint Institute of Acoustics and the Institute of Environmental Management and Assessment's draft guidance on the Assessment of Environmental Noise suggests the following significance criteria.

Noise level change dB(A)	Effect
0	No effect
0.1 to 2.9	Slight effect
3.0 to 4.9	Moderate effect
5.0 to 9.9	Substantial effect
>10	Severe effect

3.8.4 Environmental Noise Climate Measurements

The key residential receptors for noise from the new plant have been identified. These are typically the nearest properties in a variety of directions and are representative of the communities in the area surrounding the proposed additional units. The proximity of the proposed new units to the existing Kingsnorth units means that the key noise receptors are common to both existing and future units. Consequently, it is appropriate to incorporate the results of previous noise measurements that were undertaken to characterise the noise climate from the existing Kingsnorth units.

The location of the measurement positions are shown in Figure 3.8.1 and listed in Table. 3.8.1.

Table 3.8.1 – Details of Measurement Positions used in Noise Surveys

Position Code.	Description	Direction and Distance from Proposed New Units (approx) /metres	Ordnance Survey Grid Grid Reference {Eastings, Northings}	Comment
KNSC1	Kennels	800	580285,172379	Closest residential property
KNSC2	Jacobs Lane	1000	580021,172659	Next-nearest property in the north-west direction
KNSC3	Beluncle Farm	1200	580158,173379	Collection of properties to the north-west
KNSC4	Tunbridge Hill	1500	580603,174006	Collection of houses to the north
KNSC6	Nature Study Centre	700	580368,172770	An 'on-site' monitoring location where continuous noise monitoring has taken place

Position Code.	Description	Direction and Distance from Proposed New Units (approx) /metres	Ordnance Survey Grid Grid Reference {Eastings, Northings}	Comment
KNSC8	North Street	1700	581210,174200	Collection of houses to the north

Note: There are commercial premises located in the industrial estate closer to the proposed new units. However, it is anticipated that the impact of the environmental noise it will not be significant, due to the nature of the activities on the various premises and the hours of operation.

3.8.4.1 Description of Key Receptors

- House and Kennels, Position KNSC1

  This is the closest residential property to Kingsnorth power station will also be closest to the proposed new units. It is approximately 800m to west-northwest of the centre of the new units. Measurements were made on the farm-track to the south of the building, in line with the house and in the direction of the existing Kingsnorth units.

- Jacobs Lane, Position KNSC2

  These properties are located approximately 1000 metres to the west-northwest of the proposed new units. The measurements were made at the start of the grassy lane near the T-junction of Jacobs Lane and Eshcol Road.

- Beluncle Farm, Position KNSC3

  Several properties adjoin the road near Beluncle Farm, the closest being around 1200 metres to the northwest of the site of the proposed plant. The measurements were made in a lay-by to the east of the houses and are representative of noise climate at this collection of properties.

- Tunbridge Hills, Position KNSC4

  The properties in Tunbridge Hills are approximately 1500m from the centre of the proposed new units. The measurement position was located on the grassy bank near to the junction of the lane leading to White Hall Farm, in the direction of Kingsnorth power station.

- North Street, Position KNSC8

  The properties in the North Street area are approximately 1700m from the centre of the proposed new units. The measurement position was located at the end of the public bridleway with clear line of site to the Kingsnorth and Damhead Creek power stations.

Continuous monitoring of noise levels at an additional, non-residential location was undertaken to support the measurements made at the residential locations. These measurements serve to quantify the level of variability in existing industrial noise levels at position on the edge of the Kingsnorth site. They allow the potential variability of noise level at residential locations to be more fully understood and the attended survey results to be put into context.

- Nature Study Centre, [Non-Residential Monitoring Position], Position KNSC6

The measurement position was located in open area of ground approximately 100m due south of the Kingsnorth Nature Study Centre building. From this position there is clear line of sight to both Kingsnorth's existing units and Damhead Creek power station. This position was selected as it is relative close to the two power stations and hence the measurements are indicative of the level of noise propagation towards the residential properties to the North West of the site: primarily positions KNSC1, KNSC2 and KNSC3

3.8.5 Measurement Methodology

Surveys were conducted at the residential monitoring locations by visiting each measurement location in turn. Since it is known that the daytime and early evening noise climate at the majority of the residential measurement positions is dominated by contributions from traffic on the local public road network the noise surveys concentrated primarily on characterising the late evening and night-time noise climates (daytime has been taken as 07:00 to 19:00, evening as 19:00 to 23:00 and night-time as 23:00 to 07:00).

In recognition of the fact that the night time noise climate is mainly due to the operations of the existing Kingsnorth units and Damhead Creek power station the survey results collected in a variety of plant operational states have been included within this assessment and allow future noise contribution from the proposed new units to be put into context.

Where appropriate and possible, the measurement procedures outlined in British Standard 4142(1997) were followed. The microphone height was set at 1.2–1.5 m and a foam windshield was used on all occasions. The microphone was positioned at a distance remote from any major reflecting surface. Precision measuring equipment (sound level meters) were used meeting the requirements of BS EN 60804 Class 1, and/or BS EN 60651 Class 1. As most of the surveys were made overnight most measurement samples were 5 minutes in duration and in all cases the measurements were made with 'fast' meter response and 'A' weighting. Where appropriate, the measurements were paused during local traffic movements to ensure that the L_{Aeq} measurement was as representative of the industrial noise contribution as possible.

All noise measurement equipment used is maintained in calibration by regular certification by a laboratory accredited to UK standards. Each set of measurements was preceded and followed by a calibration check using the sound level meter's acoustic calibrator. Details of the equipment used in the surveys and their respective calibration details are given in Table 3.8.2 below and calibration certificates can be found in Figure 3.8.2.

Table 3.8.2 - Details of Noise Measurement Equipment

Description	Item	Model	Serial Number	Last Calibration Date
Acoustic Calibrator	B&K Calibrator	4231	1883787	September 2006
Acoustic Calibrator	B&K Calibrator	4231	1761168	September 2005
Larson Davis 2800	Sound Level Meter	2800B	0535	September 2005
	Microphone	2541	2168	
	Preamplifier	900B	1775	
RION NA-27	Sound Level Meter	NA-27	00121711	September 2006
	Microphone	UC-53A	102413	
	Preamplifier	NH-20	05399	
RION NL-32	Sound Level Meter	NL-32	00451267	August 2005
	Microphone	UC-53A	308501	
	Preamplifier	NH-21	15260	

As meteorological conditions can have effects on noise generation and acoustic propagation, wind speed, wind direction, air temperature and humidity were noted during each of the surveys

3.8.6 Current Noise Climate

The level and character of ambient noise at the key residential receptors is obviously dependent upon a variety of factors. During the daytime noise from road traffic can have an effect on the noise level at some of the residential positions, i.e. Beluncle Farm, Tunbridge Hill. However, in the evening and overnight when the traffic noise has subsided the noise from the existing Kingsnorth units and Damhead Creek power stations becomes more prominent. Similarly, it is at this time when the noise emissions from the new units would be most prominent.

Details of the noise levels measured during typical operation of the power stations shall be given in Section 3.8.6 however subjective observations were also made of the level and source of environmental noise at each of the five measurement positions. In general terms the main sources of noise which contribute to the noise climate at each location are as given in the Table below:

Table 3.8.3 – Subjective observations of noise sources during surveys in 2003-2006 surveys

Description	Dominant Noise Sources affecting noise climate	
	Day/Evening [07:00 to 23:00]	Night [23:00 to 07:00]
All	• General industrial noise from Kingsnorth and Damhead Creek power stations. {Varying contributions depending upon operation and meteorology}	• General industrial noise from Kingsnorth and Damhead Creek power stations. {Varying contributions depending upon operation and meteorology}
Kennels (KNSC1)	Plus • Noise from Kennels	Plus • None
Jacobs Lane (KNSC2)	Plus • Local and distant traffic noise	Plus • None
Beluncle Farm (KNSC3)	Plus • Local and distant traffic • Railway	Plus • Local and distant traffic
Tunbridge Hill (KNSC4)	Plus •Local traffic	Plus • None
Nature Study Centre (KNSC6)	Plus •None	Plus • None
North Street (KNSC8)	*Not observed. Site only adopted in 2006 and surveys have focussed on night time periods.*	Plus • None

Note: In all cases the relative contribution from the industrial noise source is dependent upon its operational state, i.e. in the case of the noise from Kingsnorth power station the contribution depends upon the number of operational units.

3.8.7 Noise Survey Results

A number of Environmental Noise surveys have been undertaken around Kingsnorth power station in recent years and have focussed on quantifying the typical noise climate during operation of the Kingsnorth. A summary of the surveys is given in the Table 3.8.4 below.

Table 3.8.4 – Summary of Noise Measurement Surveys 2003-2006

Index	Date	Type	Kingsnorth Operational State	Damhead Creek State
1	24-25 June 2003	Survey	All Units On	On
2	2-3 July 2003	Survey	All Units On	On
3	24 June – 3 July 2003	Continuous [at Nature Study centre and Oakham Marsh Island]	Various	Various
4	18-19 June 2005	Survey	Off	On
5	6-7 July 2006	Survey	All Units On	Off
6	28-29 October 2005	Survey	All Units On	On
7	7 July – 13 July 2006	Continuous [at Nature Study centre]	Various	Off
8	2-3 September 2006	Survey	All Units Off	On
9	9-10 October 2006	Continuous [at Nature Study centre]	Various	On
10	9&10 October 2006	Survey	Unit 4 On	On

Notes: Surveys 3, 7 and 9 serve to quantify the sensitivity of the noise climate to plant and meteorological conditions.
Surveys 4 and 8 were undertaken to quantify the 'background' noise level with Kingsnorth not operational.

Further details of the surveys are given in sections 3.8.7.1 to 3.8.7.3 below.

The surveys around the key residential receptors can be grouped into two basic categories. Firstly measurements have been made with Kingsnorth's existing units in various different modes of operation. Secondly, measurements surveys have been undertaken when all Kingsnorth's units were shutdown. As Kingsnorth has four separate generating units, total plant shutdowns are very unusual events. Hence the noise measurements may have to be undertaken in non-ideal weather conditions.

3.8.7.1 Offsite Noise Surveys – Kingsnorth Operational

Results of the various noise Measurements Surveys undertaken whilst Kingsnorth units were in various operational states are given in Tables 3.8.5 and 3.8.6 below

Table 3.8.5 – Environmental Noise Survey Results – 24-25th June 2003, 2-3 July 2003 and 29-29 October 2006: With All Units at Kingsnorth On- Load - Damhead Creek at Nominally Full Load

	24-25 Jun 2003		2-3 Jul 2003		28-29 Oct 2005	
Night time (2300-0700)	L_{A90} dB	L_{Aeq} dB	L_{A90} dB	L_{Aeq} dB	L_{A90} dB	L_{Aeq} dB
Kennels (KNSC1)	47.5	50.0	37.0	40.3	40.5	42.0
			36.0	38.5		
Jacobs Lane (KNSC2)	43.0	46.0	42.5	43.5	40.0	41.2
			29.1	37.8		
Beluncle Farm (KNSC3)	43.7	46.2	39.5	44.5	41.1	42.6
			41.0	42.5		
Tunbridge Hills (KNSC4)	40.3	42.2	36.5	38.0	37.2	38.5
			39.0	41.5		
Wind Direction	SE		W		S	
Wind speed m/s	1.0		1.0		2.2	

Table 3.8.6 – Environmental Noise Survey Results – 6th -7th July 2006 All Units at Kingsnorth On- Load - Damhead Creek at Nominally Full Load

Position	Time	L_{Aeq} dB	L_{A90} dB	Arithmetic Mean L_{Aeq} dB	Minimum L_{Aeq} dB	Arithmetic Mean L_{A90}	Minimum L_{A90}
Kennels (KNSC1)	00:23	40	38.5	42.6	39.3	39.0	37.7
	01:04	40	38.9				
	22:40	39.3	37.7				
	23:06	45.9	39.4				
	23:13	47.7	40.3				
	23:48	42.5	39				
Jacobs Lane (KNSC2)	00:09	35.5	34	37.0	34.4	34.3	32.9
	00:39	39	35.5				
	01:20	34.4	32.9				
	22:27	37.2	34.1				
	22:53	36.3	33.5				
	23:25	39.5	35.5				
Beluncle (KNSC3)	00:30	41.2	33.9	40.9	34.4	34.5	31.5
	01:53	34.4	31.5				
	23:07	47	38				
Tonbridge Hills (KNSC4)	00:12	40.6	37	39.0	37.5	36.5	35.5
	01:17	37.5	35.5				
	22:50	39	37				
North Street (KNSC8)	01:04	37	34.5	43.1	36.5	34.7	34.0
	01:34	37	35.5				
	22:34	36.5	34				
	23:52	61.8	34.6				
Wind Speed and Direction	1 to 2 m/s from a south-westerly direction						
Plant State	All Units at Kingsnorth On- Load - Damhead Creek Nominally Full Load						

Table 3.8.7 - Results for Noise Survey – Overnight 9th and 10th October 2006.

Site	Date	Time	L_{A90} dB	L_{Aeq} dB
Kennels (KNSC1)	9th Oct	02:04	40.0	41.5
	9th Oct	23:42	42	43
	10th Oct	01:20	43	43.5
Jacobs Lane (KNSC2)	9th Oct	01:52	38.5	39.5
	9th Oct	23:56	37.5	39
	10th Oct	01:43	38	39.5
Beluncle (KNSC3)	9th Oct	01:40	40.0	41.5
	10th Oct	00:48	39	40
	10th Oct	02:22	38.5	40
Tonbridge Hills (KNSC4)	9th Oct	01:27	40.5	42.0
	10th Oct	00:30	38	39.5
	10th Oct	02:11	37.5	38
North Street (KNSC8)	9th Oct	01:13	37.5	40.5
	10th Oct	00:13	37	38.5
	10th Oct	02:00	37	39
Nature Study Centre (KNSC6)	10th Oct	01:05	41.5	43.0
Wind Speed and Direction	2m/s from South early morning on 9th Oct 06. Calm or extremely light wind from S overnight 9-10th Oct.			
Plant State	Damhead Creek power station at base-load, Kingsnorth Unit 4 at half-load. Units 1 to 3 off.			

3.8.7.2 Offsite Noise Surveys – Kingsnorth Shutdown

Results of the noise measurements surveys undertaken whilst all four units at Kingsnorth were shutdown overnight.

Table 3.8.8 – Results from Environmental Noise Surveys taken around Kingsnorth Power Station during 2005 whilst all Kingsnorth Units Off Load.

All Night time [23:00 to 07:00]	18-19 June 2005	
	L_{A90} dB	L_{Aeq} dB
Kennels (KNSC1)	39.5	40.5
Jacobs Lane (KNSC2)	39.1	40.2
Beluncle Farm (KNSC3)	41.8	44.3
Tunbridge Hills (KNSC4)	Not Representative	
Wind Direction and Wind speed m/s	Calm	

Table 3.8.9 – Environmental Noise Survey Results – 2nd-3rd September 2006 All Units at Kingsnorth Off- Load - Damhead Creek at Base-Load

		2-3 September 2006	
Position	**Time**	**L_{A90} dB**	**L_{Aeq} dB**
Kennels(KNSC1)	21:47	48.8	53.8
	00:21	41.7	45.2
	00:27	39	41.6
Jacobs Lane (KNSC2)	21:33	47.9	51.5
	22:00	46.4	50.6
	00:05	42.1	44.5
	00:40	37.5	40.7
Beluncle (KNSC3)	22:45	36.9	43.3
	22:52	37.6	44.6
	23:45	37.7	41.6
Tonbridge Hill (KNSC4)	23:00	45.2	50
North Street (KNSC8)	23:15	42.1	46.4
Wind Speed and Direction	2-3 m/s from south westerly direction		

Note: As the wind speed was around 2-3 m/s throughout the survey and wind-foliage noise was apparent at all locations these measurement cannot be considered to be representative of the industrial noise contribution and therefore cannot be used to characterise the “background” noise climate.

3.8.7.3 Continuous Noise Monitoring

As mentioned in Section 3.8.4 some continuous noise monitoring of the noise level at on-site locations has been undertaken to allow better understanding of the potential variability in off-site noise levels that might arise due to Kingsnorth being in various operational states and also due to meteorology induced propagation effects.

Continuous monitoring results - June/July 2003

A week of continuous unattended monitoring was undertaken at the Nature Study Centre and on the Oakham Marsh Island. These continuous noise measurements were accompanied by monitoring of wind speed and direction. Measurements were made at the Nature Study Centre (KNSC6) and also on Oakham Marsh Island to indicate the variability of the noise climate and assist in putting the results from the attended off-site noise surveys into context. In general the continuous noise measurements indicate that the noise level at the Nature Study Centre and Oakham Marsh Island are sensitive to meteorological conditions. For similar plant conditions the measured L_{A90} level can vary by more than 3dB, depending upon wind direction. Therefore it can realistically be assumed that the noise level at the residential properties will exhibit at least the same amount of variation due to meteorological effects, depending upon how far they are from Kingsnorth and Damhead Creek power stations.

Table 3.8.10 - Kingsnorth - Mean Statistics of Continuous Noise Monitoring 2003

	Nature Study Centre (Mean ± Std. Dev.)		Oakham Marsh Island (Mean ± Std. Dev.)	
Period	L_{Aeq} dB	L_{A90} dB	L_{Aeq} dB	L_{A90} dB
Night (2300-0700)	46.5±5.5	42.6±5.0	42.1±4.2	38.6±4.0
Day (0700-1900)	48.8±3.2	43.6±3.8	46.1±4.6	40.1±3.2
Evening (1900-2300)	46.6±3.8	42.5±4.3	43.7±4.0	39.7± 3.5

The monitoring exercise at the Nature Study Centre was repeated in July 2006, except that on this occasion Damhead Creek power station was shutdown for the duration of the exercise, consequently these measurements represent a quantification of the environmental noise level arising from the operation of the units at Kingsnorth in the absence of Damhead Creek power station.

A graph showing the variation in L_{Aeq} and L_{A90} noise levels is given in Figure 3.8.1 and summarised into mean and standard deviations for Day, Evening and Night periods in Table 3.8.11 below

Table 3.8.11 - Summary of Continuous Noise monitoring at Nature Study Centre (KNSC6) July 2006

	Nature Study Centre (Mean ± Std. Dev.)	
Period	L_{Aeq} dB	L_{A90} dB
Night (2300-0700)	39.2 ± 4.9	35.5 ± 3.9
Day (0700-1900)	45.5 ± 3.1	40.4 ± 3.2
Evening (1900-2300)	43.0 ± 3.7	38.9 ± 2.5

To assist in understanding the current noise climate further continuous noise monitoring was completed in October 2006 and contained a period when Damhead Creek power station was shut-down thereby allowing the specific contributions from each plant to be identified.

A graph showing the results is shown in Figure 3.8.5 and summarised statistically in the following table.

Table 3.8.12 - Summary of Continuous Noise monitoring at Nature Study Centre (KNSC6) 9th-10th October 2006.

Period	Damhead Creek Power Station **Shutdown**		Damhead Creek Power Station **On-Load**	
	L_{Aeq} dB	L_{A90} dB	L_{Aeq} dB	L_{A90} dB
	Mean ± Stdev	Mean± Stdev	Mean± Stdev	Mean± Stdev
Night (2300-0700)	**43.3** ± 3.4	40.3 ± 2.9	**46.8** ± 4.3	44.5 ± 3.9
Day (0700-1900)	46.7 ± 3.0	42.4 ± 3.4	49.3 ± 3.1	46.0 ± 2.6
Evening (1900-2300)	44.4 ± 3.0	40.9 ± 2.9	46.9 ± 3.0	44.8 ± 3.1

Note: Data collected when local wind speed is greater than 2m/s has been excluded

3.8.8 Quantification of existing baseline

A comprehensive review and cross-comparison of these two noise monitoring datasets shows that the environmental noise climate at around Kingsnorth power station is highly complex and affected by the power stations being in various operational states combined with meteorological induced propagation effects. Hence, for the purpose of assessing the future noise from the new units it is necessary to make some assumptions regarding the various contributors to the current noise climate.

In Tables 3.8.11 the mean noise level data collected overnight at the Nature Study Centre whilst Damhead Creek was off-load was significantly less than that collected when Damhead Creek was operational. When Damhead Creek was shutdown in July 2006 the mean overnight noise level at the Nature Study Centre was in the region of 39.2 dB L_{Aeq} and 35.5 dB L_{A90}, but this was typically for only 2 out of the 4 units on-load. As the Units 5 and 6 are 2x800MW in capacity they are capable of generating a similar amount of power as 3 of the existing 500MW units. It is therefore most appropriate to consider the level of noise level that would arise overnight from operation of 3 of the existing units. Making the reasonable assumption that the noise emitted from each unit is basically equivalent then it could be expected that the operation of 3 of the existing units overnight would, on average, give rise to a noise level 1.8 dB greater than that for 2 units, namely a mean L_{Aeq} of 41dB.

This provides an estimate of the mean continuous noise level component at the Nature Study Centre attributable to the current overnight operation of Kingsnorth existing units when generating an equivalent amount of power as the proposed new units. With regard to the contribution from Damhead Creek power stations operation, it is generally more stable in its generation pattern. Observations made at the Nature Study Centre monitoring point overnight whilst only Unit 4 of Kingsnorth power station was on-load (the most distant of the four units) suggested that the steady continuous noise climate was overwhelmingly associated with Damhead Creek's operation. Based on this subjective observation, it is possible to infer that the base-load operation of Damhead Creek power station was almost solely responsible for the 43 dB L_{AEQ} noise level experienced at the Nature Study Centre, (See Table 3.8.7).

In addition considering this data the continuous monitoring at the Nature Study Centre in October 2006 contained periods of monitoring when Damhead Creek was shutdown and also operational which allows the relative noise contributions from each plant to quantified. By considering the data collected overnight when Kingsnorth had 2 to 3 units in operation, Table 3.8.12, it is estimated that the specific noise levels from Damhead Creek and Kingsnorth power stations are 44.2 and 43.3 dBA respectively, combining to give 46.8 dBA.

These estimates are slightly higher than those derived earlier so it is proposed that averages of these noise level estimates will be taken for the purpose of characterising the noise climate at this on-site reference location:

- specific noise level from Damhead Creek is 43.6dB L_{Aeq}, and
- specific noise level from Kingsnorth (3 unit operation) is 42.1 dB L_{Aeq},

The calculated total noise level from these two power stations is around 45.9 dB $L_{Aeq,}$ which is in very good agreement with the mean overnight L_{Aeq} noise levels of around 46.5 dB and 46.8 dB that were measured in 2003 and 2006 whilst both plants were operational.

This approach allows estimates of the mean noise levels from Kingsnorth and Damhead Creek at the Nature Study Centre to be made, which can be used to infer mean noise levels at residential locations to the west of the plants. However, the properties to the north at Tunbridge Hill and North Street have a slightly different view of the power station and are subject to noise contributions from the plant items on the stack-side of Kingsnorth. As the basic aspect of these properties relative to Kingsnorth is not dissimilar to that of the monitoring at Oakham Marsh Island, it is appropriate to use this medium term monitoring data in a similar way to estimate the noise level at these locations. The medium term monitoring that took place at Oakham Marsh Island, Table 3.8.10, showed that the mean noise level was 42.1±4.2 dBA.

If it is assumed that this is solely attributable to Kingsnorth and Damhead Creek operations then by extrapolating Damhead Creek power station noise contribution to this location Kingsnorth mean noise level at this location due to stack-side plant can be estimated as 42 dBA for 3 unit operation. Estimate of the current noise climate at residential receptors due to 3 Kingsnorth Units generating and Damhead Creek being on load are given in the following table

Table 3.8.13 - Estimated Noise Levels from Typical Kingsnorth and Damhead Creek Operation

Position		Kingsnorth (3 units) L_{Aeq} dB	Damhead Creek L_{Aeq} dB	Combined L_{Aeq} dB
Kennels	(KNSC1)	43.6[a]	41.1	45.5
Jacobs Lane	(KNSC2)	40.5[a]	39.8	43.2
Beluncle	(KNSC3)	38.0[a]	39.9	42.1
Tunbridge Hills	(KNSC4)	41.9[b]	38.2	43.4
North Street	(KNSC8)	41.3[b]	37.3	42.8
Nature Study Centre	(KNSC6)	42.1[a]	43.6	45.9

Note: Based on extrapolating continuous monitoring results for [a] Nature Study and [b] Oakham Marsh Island

3.8.9 Environmental Noise from Units 5 and 6

The proposed new units will each comprise of the following plant items which

- Steam turbines and associated generators
- Induced (ID) and Forced Draft (FD) fans
- High pressure steam lines, valves and vents
- Combustion, Boiler and Milling plant
- Transformers
- Flue Gas Desulphurisation Plant
- Mobile coal handling plant
- Coal transfer conveyors
- Gypsum/Limestone Handing plant
- Start-Up Gas Turbine

The noise signature from the new units will typically consist of steady and continuous noise from the turbo-machinery, boilers, transformers, cooling water systems, FGD plant and auxiliary plant. There will also be some intermittent noise, principally from steam emission during unit start-up and fuel handling activities but the majority of these plant items will be contained within dedicated plant buildings and their noise emissions will be substantially attenuated.

At this stage of the development, the design of the new units is not precisely determined. Therefore it has not been possible to develop a comprehensive noise model of all the noise sources associated with the operation of the plant. However, E.ON UK has experience and actual noise levels from coal fired plant fitted with FGD which have been designed and built using Best Available Techniques. Using this information it is estimated that the noise level associated with the steady continuous operation of the new units can be controlled to a level equivalent to 45-47 dB at 400m from the nominal plant centre using appropriate noise control techniques

For the purpose of calculating the likely noise levels at the key residential receptors it has been assumed that the noise radiates out over a hemispherical surface and undergoes no additional attenuation. This is a naturally conservative assumption which ignores any effect associated with atmospheric absorption, ground and barrier screening effects which would typically result in additional attenuation. Consequently it is highly likely that the actual noise level from the new units will actually be less than these estimated levels.

Overall, this modelling approach is consistent with that adopted for estimating the existing noise level and hence allows the environmental noise level from the new units to be compared to that from the existing units.

In general terms all positions will be receive some contributions from the Turbine Hall, Boiler House, however the Kennels (KNSC1), Jacobs Lanes (KNSC2) and Beluncle (KNSC3) will, due to the orientation of the plant, receive additional noise contributions from the transformers. Whereas the other locations, Tunbridge Hills and North Street, will have line of sight to the Air/Fuel Handling and FGD Plant and these orientation effects have been taken into the basic noise model.

3.8.10 Environmental Noise Level due to Units 5 and 6

The overall steady continuous noise level associated with the future operation of both the new units is estimated at the Key Residential Receptors to be as follows:

Table 3.8.14 - Estimated Noise Levels from Units 5 and 6

Location		Specific Noise Level from Units 5&6 L_{Aeq} dB
Kennels	[KNSC1]	39.1
Jacobs Lane	[KNSC2]	36.6
Beluncle Farm	[KNSC3]	35.2
Tunbridge Hill	[KNSC4]	35.4
North Street	[KNSC8]	34.7

3.8.10.1 Assessment

As has been mention earlier, Kingsnorth power station currently has four separate generating units therefore planned total plant shutdowns are extremely unusual. Although efforts have been made to characterise the “background” noise climate they were weather-affected and cannot be considered to be representative. Consequently it is not possible to undertake a truly robust assessment of the likelihood of noise complaint using the BS 4142 methodology and it is considered more useful to concentrate on comparing the noise level from Units 5and6 with that from the existing plant. Notwithstanding this, to allow a basic BS4142 assessment to be undertaken the minimum night time L_{A90} levels measured at the residential locations [Tables 3.8.8 and 3.8.9] are summarised in the table below.

Table 3.8.15 – Comparison of Environmental noise from Units 5 & 6

Location	Background Noise Level L_{A90} dB #	Difference between Rated L_{Aeq} Noise level from Units 5&6 and Background L_{A90} dB	Change in Noise Level from Kingsnorth site due to operation of Units 5&6 L_{Aeq} dB	Change in *Overall* Industrial Noise Level from Kinsgnorth and Damhead Creek Plant due to Units 5&6 Kingsnorth L_{Aeq} dB
Kennels [KNSC1]	39.0	0.1	-4.6	-2.4
Jacobs Lane [KNSC2]	37.5	-0.9	-3.9	-1.7
Beluncle Farm [KNSC3]	36.9	-1.7	-2.8	-0.9
Tunbridge Hill [KNSC4]	45.2	-9.8	-6.5	-3.4
North Street [KNSC8]	42.0	-7.3	-6.6	-3.5

Note: # - At positions KNSC4 and 8 the measured background L_{A90} is actually greater than noise levels measured with one or more Kingsnorth units operational, hence are not considered to be particularly reliable.

From a BS4142 assessment perspective the difference between the rated noise level from the new units and the reliable night time background L_{A90} level are close to 0 dB, which is below the 5dB region where the noise is considered to be of 'marginal significance".

In recognition that the new units will directly replace the existing 4 units it certainly more informative to consider how the new noise level relates to current levels. In the same table the difference between existing and future contribution to environmental noise levels due to Kingsnorth's operation are shown as estimates as to how overall industrial noise will be reduced due to the switching of generation to the new units.

The comparison shows that the noise level contributions from the new plant will be between 2.8 and 6.6 dB less than current levels and that this will translate into reductions between 0.9 to 3.5 dB in the overall industrial noise affecting residential locations.

From a significance perspective, using the criteria detailed in Section 3.8.3 the operation of Units 5 and 6 compared to the continued operation of the existing four units reduces the overall noise level from the site and has no detrimental effect on the noise climate.

3.8.10.2 WHO Guidelines

When considering future noise from the new units it is also appropriate to consider the guidance provided by the World Health Organisation regarding the levels of noise that will give rise to sleep disturbance.

The WHO guidance indicates that measurable effect on sleep can occur for free-field noise levels around 42 dB L_{Aeq}. As can be seen from some of the results of measurements surveys there are circumstances arising from certain meteorological and

operational conditions of the power stations when the overnight noise level is slightly in excess of this guideline. As the noise associated with the operation of the new two units will be less than the existing four units the overall noise climate will improve and it is predicted that at all key residential locations the noise level will reduce to be less than 42 dB L_{Aeq} at the overwhelming number of properties.

3.8.10.3 Noise During Interim Development Phase

As it is proposed that the existing four units at Kingsnorth will continue to operate within the running hours limitation required by the LCPD. From an environmental noise perspective, the construction of Units 5 and 6 will take place whilst the existing four units are operational and as such the overall noise emissions from E.ON UK's Kingsnorth site will rise. However the additional noise will be controlled under arrangement agreed with the Medway Borough Council as Control of Pollution Act Section 61 Prior-consenting Process.

With regard to the noise emissions from the existing plant the proposals for the ongoing control and management of it have been included within the station's PPC permit application. It is proposed that 2 of the existing Kingsnorth units will be taken out of service once the first of the new units is commissioned. Since the combined noise from the operation of Units 5 and 6 is predicted to be less than that from the existing station the noise level in this interim phase of the development will be less than from equivalent operation of the existing units. Once the second of the new units is commissioned the remaining two of the existing Kingsnorth units will be taken out of service and the environmental noise contribution from the Kingsnorth site will be solely associated with the operation of the new units and will as given in Table 3.8.14.

3.8.11 Proposed Environmental Noise Criteria (ENC)

It is E.ON UK's overriding commitment that the environmental noise from the new units will be less than from the existing units. It is proposed that the following Environmental Noise Criteria limits for operational noise from the new units should be adopted at the residential properties.

Table 3.8.16 – Environmental Noise Criterion at Residential Properties

Location		Environmental Noise Criterion # L_{Aeq} dB
Kennels	[KNSC1]	39
Jacobs Lane	[KNSC 2]	37
Beluncle Farm	[KNSC 3]	35
Tunbridge Hill	[KNSC 4]	35
North Street	[KNSC 8]	37

rounded to the nearest whole number

In circumstances such as these, where the community noise climate is already subject to variable contributions from other industrial activities it is appropriate to define an operational Plant Noise Criterion in terms of a noise limit at a specified distance.

In recognition that there will be considerable more plant items sited on the east-side of the site than on the west of the plant, two separate noise criteria consistent with

achieving the ENC noise limits at the nearest residential properties given in Table 3.8.16 are specified.

These will be 45 and 47 dBA at 400m from the centre of the plant in westerly and easterly directions respectively. These design criteria will be adopted for the new units and will form part of the performance guarantees that the plant supplier will be required to meet. This noise limit will apply to all operational modes of the new units, the only exception being emergency conditions.

BS 4142 and PPG 24 both identify that the likelihood of public complaint is greater if the industrial noise has a distinctive character, i.e. it is tonal or impulsive. In recognition of this EON UK will require the plant supplier of the new units to guarantee that the plant noise at residential properties will not contain any tonal or impulsive characteristics that would cause the noise to be adjudged distinctive and hence liable to rated 5dB higher in a BS 4142 assessment.

3.8.12 Non-Continuous Noise Emissions

3.8.12.1 Mobile Plant Noise

It is proposed that the new units will utilise the existing unit's coal stock handling and transfer equipment. As these plant items will operate external to the main plant buildings enclosures there is a potential that they could be a significant source of noise. To ensure that the operation of the new units does not cause public annoyance/complaint all external plant will be inspected, maintained and replaced if necessary.

3.8.12.2 Construction noise

At this stage it is not possible to state definitively what the noise impact from the construction of proposed plant would be at residential positions and it is anticipated that it would be managed under the Control of Pollution Act Section 61 Prior Consent process. Notwithstanding this, a minimum initial requirement to control noise during the construction phase of the project will be placed upon the contractor with the noise limits as detailed in the table below.

Table 3.8.17 - Construction noise limits, L_{Aeq} dB at the nearest residential premises

Day(s)	HOURS	NOISE LIMIT L_{Aeq} dB
Monday to Friday	0700-1900 (Day)	70
	1900-2200 (Evening)	60
	2200-0700 (Night)	ENC*
Saturday	0730-1730 (Day)	65
	1730-0730	ENC*
Sunday	0000-2400	ENC*
* Operational noise limit which is consistent with overall noise from site being within the Environmental Noise Criterion		

The above requirements will be written into the contracts of those undertaking construction. From the experience of other projects and construction sites, E.ON UK is confident of the contractors' ability to achieve the above noise levels by exercising a degree of control over site activities and by attention to the recommendations set out in BS 5228 Parts 1, 2, and 4.

Only during infrequent periods of construction work when work on site clearance, levelling and foundations is carried out, is it likely that noise levels would approach the above criteria. During later phases, particularly when installation work is being carried out inside buildings, it would be likely that noise levels would be considerably lower. In general the noise level outside the nearest residence would not be expected to exceed a level of 60 L_{Aeq} dB during normal construction activity. There will be some need for piling for the main plant structures but the local impact of piling will be minimised by limiting the hours of working, as for other construction work, and by utilising augured piling where possible. So far as is practicable piling noise will be contained within the noise limits specified for construction in Table 3.8.17

3.8.13 Traffic Noise

For the purposes of assessing the significance of effects associated with increases in traffic volumes and/or HGV composition as a result of the development, the following criteria have been used

	Magnitude Variation in Road Traffic Noise Level (dB)
Significant Adverse	> +10.0
Moderate Adverse	+5.0 to +9.9
Minor Adverse	+3.0 to +4.9
Neutral	-2.9 to +2.9
Positive	> -3.0

Based on a comprehensive traffic flow study undertaken as part of this EIA the worst case traffic noise scenarios have been identified. At the peak of construction activity, when the greatest number of vehicles are travelling to and from the site the increased flow of traffic has been used to determine the likely noise level increase at properties adjoining the route. The increase in noise level due to the additional traffic movements will be greatest at those properties which experience the lowest baseline traffic flow. These are the properties adjoining Roper's Lane and hence the assessment has focussed on quantifying the change in the noise levels at these locations. Any increase in noise level associated with the development's traffic will be less at other locations.

Using baseline and development traffic flows the Calculation of Road Traffic Noise (CRTN) methodology has been used to calculate the changes in L_{A10} noise level that will arise. The predicted diurnal traffic flow indicates that the greatest percentage change in traffic will be associated with the journeys taking place during the hours starting 06:00 and 18:00. For the AM peak [06:00 – 07:00], the PM peak [18:00 – 19:00] it is calculated that the $L_{A10,1hr}$ noise levels will each increase by around 8 dB, which according to the significance criteria above is considered to be a 'moderate adverse' change. At other times of the day the percentage increase in the traffic flow will be considerably less and the increase in the $L_{A10,18hr}$ level [06:00 to 24:00] is calculated to be 2.7 dB which is of 'neutral' significance.

This assessment relates to the traffic noise associated with the predicted flow for the peak in construction activity. However it is calculated that for 23 months of the construction phase the significance of the increase in traffic noise during AM and PM peak periods will decrease to 'minor adverse' and the effect on the L_{A10},18hr will remain of 'neutral' significance.

3.8.14 Operational Vibration

There is no foreseeable disturbance in public or residential areas due to ground vibration resulting from the operation of the proposed new units. Indeed the existing Kingsnorth power station contains steam turbines which are broadly similar in size to those proposed for the new units and has and continues to be operated without causing adverse vibration effects in the area. The vibration levels from the new plant will be controlled by applying good engineering practice so that noise emission is minimised and the efficient operation and life of plant is not affected.

3.8.15 Wildlife

Some of the estuary areas surrounding the Kingsnorth and Damhead Creek power station have been designated special status due to their diverse wildlife. Consequently, when assessing a new industrial plant it is appropriate to consider the potential impact it may have on the surrounding wildlife as well as the local human population.

The overall environmental impact of the construction and operation of the new units on the local wildlife is considered in more detail in Section 3.5. However, from an environmental noise perspective the bird life is especially abundant around Kingsnorth, despite the presence of noise from the two power stations, suggesting that the bird life has become used to the noise from the operations of the plant. Therefore, as it is predicted that the operational noise from the new units will result in an overall decrease in noise level at residential locations it is unlikely that the noise from the units will have an impact on the wildlife.

During construction there will be some periods of elevated noise levels. The continuous noise monitoring at Oakham Marsh Island in 2003 showed that the day time noise climate already contained some peak noise levels of a similar magnitude to those that would be expected during the construction phase of the new units.

3.8.16 Noise Complaint Management

The existing four units at Kingsnorth power station operate within an Environmental Management System which satisfies the requirements of ISO 14001. As part of this system there is a specified procedure for logging and responding to public complaint regarding noise and acting to prevent re-occurrence.

Kingsnorth Environmental Management System will be extended and customised to cover specific issues associate with the new units. Therefore, in the event of public complaint regarding noise during the construction and operation of the proposed new units, Kingsnorth power station will take appropriate action, where possible, to prevent reoccurrence.

3.8.17 Mitigation and Quality Control

In order to satisfy the Environmental Noise Criterion and minimise the noise emissions from the new plant, E.ON UK will require the contractors to guarantee that the steady noise from the new units will satisfy the ENC and that this will be achieved by incorporating the following mitigation measures into its design and layout, where necessary and appropriate:

- Majority of plant to be contained within the main unit plant buildings
- Generator transformers: low noise design
- Pumps and fans: Low noise design
- Outdoor auxiliaries to be encapsulated within acoustical enclosures
- Ventilation fans: installation of silencers

E.ON UK's specifications to the contractors will require that quality assurance procedures be implemented during design, construction, commissioning and operation. These procedures will require the audit of noise specifications placed upon manufacturers. This audit will be accomplished by testing the manufacturer's ability to meet these specifications, by assessing the compatibility of these specifications with the off-site criteria and by testing the performance of delivered plant.

Measurements of site clearance and construction noise will be made to ensure compliance with the specifications and remedial action will be carried out if necessary. During the commissioning process noise level measurements will be made to ensure compliance with the specifications and remedial action will be carried out if possible and necessary. Surveys of noise levels outside the site will be undertaken during operation to enable the plant to be assessed against the Environmental Noise Criterion. Further surveys will be undertaken as necessary.

3.8.18 Summary

An environmental noise impact assessment for the proposed addition of two new units (5 and 6) at the Kingsnorth site has been completed. The assessment has focussed on key residential receptors which are representative of the residential community surrounding the Kingsnorth power station site.

The local residential areas are already subject to contributions from the existing four generating units and Damhead Creek power station therefore the noise from the new units has been considered relative to this climate. As the new units are expected to operate continuously it is especially important for the environmental assessment to consider the noise impact level over-night.

Noise level criteria have been derived which will ensure that operational and construction noise from the proposed two new units should not give cause for complaint and which are below the criteria recommended in relevant guidelines.

Environmental Noise Limits for the overall noise level contribution from the proposed new units are suggested at specified key residential locations. The staged switching over in electricity generation from the existing to the new units will mean that there will be a gradual reduction in noise level associated with the operation of the plant on the Kingsnorth site, which will ultimately result in the noise from site being between 2.8 and 6.6 dB less than from the existing units.

Noise criterion at a fixed distance from the new units will be adopted which is consistent with achieving these Environmental Noise Criteria and the plant supplier will be required to guarantee they will be met. Compliance with the fixed distance and residential operational noise criteria will be tested and demonstrated following the commissioning of the plant.

Increases in traffic noise associated with the development have been assessed and during the peak phase of commissioning the significance of increases in $L_{A10,1hr}$ at AM/PM peaks at properties on Roper's Lane are 'moderate adverse' whilst the significance of the increase in L_{A10},18hr is considered to be 'neutral'.

BIBLIOGRAPHY

BS 4142: 1997. Method for Rating industrial noise affecting mixed residential and industrial areas.

BS EN 60805 Specification for integrating-averaging sound level meters.

BS EN 60651 Specification for sound level meters.

BS 5228 Noise control on construction and open sites. Parts 1-4.

Calculation of Road Traffic Noise. Department of Transport.

Planning Policy Guidance PPG 24. Planning and Noise.

Joint Institute of Acoustics and the Institute of Environmental Management and Assessment's draft guidance on the Assessment of Environmental Noise, April 2002

ISO 9613/2: Part 2: Acoustics - Attenuation of sound during propagation outdoors. General Method of Calculation

3.9 Socio-Economic Effects

3.9.1 Introduction

The purpose of this section is to briefly describe the employment structure within the Medway area. Regional employment needs will be considered, alongside the likely impact for the region that arises from constructing and operating the proposed Kingsnorth units 5 and 6.

In 1999, Medway Council adopted an Economic Development Strategy for the period up to 2010. More recently a review of this document occurred in April 2005, in preparation for a new draft Economic Development Strategy. It is worth noting that the strategy does not focus entirely on economic development. It also refers to local sustainable development; the wider social and economic benefits and the aim to improve the quality of life for residents in the Medway area. Furthermore, it also sets a target of creating and additional 11,000 new jobs, including 1,000 construction jobs and High-Tech Manufacturing (including pharmaceuticals and engineering) (4,200 jobs). The review also reinforces the focus on themes, such as retaining and developing skills, successful development, image and competitiveness.

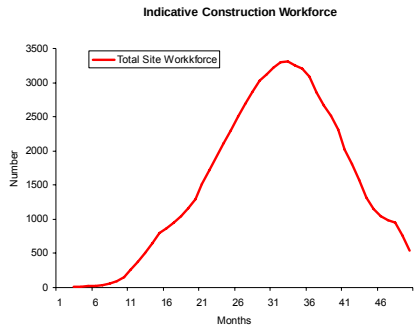
The Office of National Statistics publishes monthly and quarterly unemployment data. For April 2005 – April 2006, the unemployment rate for the Medway Towns area stood at 4.9% (Official Labour Market Statistics, 2006a); for Kent as a whole figure was slightly higher at 5.0%% (Official Labour Market Statistics, 2006b). This compares to the National Unemployment Figure of 5.6%, in the three months previous to September 2006 (ONS, 2006).

3.9.2 Employment associated with the new plant

The construction of the proposed Kingsnorth units 5 and 6 will also ensure a continuing employment presence at the power station. This will help secure longer term prospects for permanent staff already living in the locality and, in addition, provide direct employment for the local economy in terms of the need to provide services and materials.

At present, E.ON UK directly employs over 160 staff with approximately a further 90 support staff on a contract basis in relation to the existing units at Kingsnorth. Furthermore, over 70% of the employees live within 20 miles of the site. In addition to this the power station employs many local contractors and makes local non-fuel purchases to the value of over £500k per year (for example meat for the staff canteen is bought from the local butcher).

The total cost of construction for the proposed Kingsnorth units 5 and 6 is likely to be in excess of £1 billion spread across four years. The existing units are over 30 years old and coming towards the end of their useful life. Therefore, this represents a major new investment at the Kingsnorth site. Construction and commissioning is programmed to last for 48 months. The number of construction workers is expected to rise up to 3300 at the peak of construction for a short period. It should be noted, however, that this figure represents a peak requirement and does not reflect the number of construction workers who will be required on a day-to-day basis throughout the construction phase, as shown below.



To support the needs of sustainable development, E.ON UK will seek to employ as many local businesses and people as possible and will place this requirement on its contractors. The new units' construction and ongoing operation will benefit the local economy. Where specific skills have to be sourced from a wider geographical area, it is proposed that construction workers will reside in local accommodation within the Medway area. This will assist in distributing the economic benefit of the development amongst the surrounding communities.

Once the new units are operational, it is expected that a similar number of staff to those currently employed will be required for operating the units (although there are fewer generating units there is additional flue gas environmental clean up equipment requiring staff). There will be an ongoing succession requirement. Typically E.ON UK has employed 2-3 engineering apprentices per year from the local schools. The successful development of Kingsnorth units 5 and 6 will mean that this number will at least continue and potentially increase for the foreseeable future. In addition to recruiting apprentices, E.ON UK is doing a lot to encourage young engineers in the UK. E.ON UK is working to support teachers and encourage children to consider engineering as a career choice. The company also has one of the leading graduate training schemes in the industry. The operation of the Kingsnorth units 5 and 6 will secure the jobs managed by existing station staff. The site will continue to make use of existing local services.

3.9.3 Conclusions

There will be a considerable number of jobs available during the construction and commissioning phase. This presents a number of opportunities, both to local people and the local and wider economy.

It is proposed that construction workers will reside in accommodation throughout the surrounding area. The economic benefit will therefore be spread across the locality.

The proposed Kingsnorth units 5 and 6 will assist in providing replacement generation capacity for the future whilst securing the long-term employment prospects for station staff and local contractors. There are current and future opportunities for the employment of apprentices from local schools.

REFERENCES

Official Labour Market Statistics, 2006a. *Labour Market Profile Medway Towns*. National Statistics: London. Available at: http://www.nomisweb.co.uk/reports/lmp/la/2038431810/report.aspx.

Official Labour Market Statistics, 2006b. *Labour Market Profile Kent*. National Statistics: London. Available at: http://www.nomisweb.co.uk/reports/lmp/la/1967128594/report.aspx.

ONS (Office for National Statistics), 2006. *Labour Market: Employment*. Office for National Statistics: London. Available at: http://www.statistics.gov.uk/CCI/nugget.aspx.

3.10 Cultural Heritage

3.10.1 Summary

Archaeology South-East was commissioned by E.ON UK to carry out an archaeological desk-based assessment of land currently proposed for the development of the new units 5 and 6 at Kingsnorth power station, situated approximately 2.5km east of Hoo St Werburgh village on the Hoo Peninsula, Kent. The proposed units are located immediately to the north of the existing power station, and associated construction lay-down areas are proposed within the adjacent land area and within a pocket of land to the north east of the Kingsnorth industrial estate (Figure 3.10.2 – numbered as Figure 2 in the Figures relating to Section 3.10).

The recorded evidence suggests that the area of proposed development (the `Site'), and the surrounding area (the `Study Area'), contains significant archaeological potential, dating from the Bronze Age to the present. Based on the results of this desk-based assessment, a total of 70 separate entries have been included in the gazetteer of sites, structures and findspots (Figure 3.10.10 and Appendix E2). This data indicates the presence of multi-period activity in the immediate vicinity of the Site (Site Nos. 7, 47, 51, 60, 66 and 70), and a series of medieval or post-medieval flood defence systems identified across the Study Area (Site Nos. 61-64).

The accompanying geoarchaeological assessment of the Study Area concluded that there is also a high potential for significant palaeoenvironmental data to survive within the organic rich alluvial silts and peat deposits, which are likely to lie beneath and marginal to the Site. The presence of Holocene stratigraphies within the study area, that are likely to contain dateable archaeological horizons, is considered probable, allowing archaeological material that has been shown to be associated with peat units to be placed in a detailed environmental context (Appendix E4).

Key organic sediments, deposited during a temperate episode in the Pleistocene, are considered to lie within a former, palaeo river channel that appears to skirt the Site. Sediments that can be assigned to temperate/interglacial episodes would be of possible national importance, and the potential for contemporary archaeological material to exist within these sediments should be considered a possibility.

It is likely that evidence recovered in the course of this study represents only a small proportion of the archaeological resource, and it is therefore anticipated that additional, as yet unrecorded remains may exist within the Site, including those buried beneath deep alluvial deposits.

Since the nature and extent of the proposed development has not yet been finalised, no detailed assessment of its likely impact can be made at this stage.

Furthermore, there is currently insufficient information about the nature and condition of archaeological deposits within the development site to assess the impact the proposed development will have on them. It is therefore recommended that a pre-

determination archaeological evaluation is undertaken before the full archaeological impact of the proposals and scope for mitigation can be properly considered.

3.10.2 Introduction

Archaeology South-East (a division of the University College London Field Archaeology Unit) was commissioned by E.ON UK to carry out an archaeological desk-based assessment of the site of the proposed new units at the Kingsnorth power station, Hoo St Werburgh, Kent (Figure 3.10.1).

The site of the proposed units 5 and 6 (Figure 3.10.2), hereafter referred to as the `Site', is located on the northern banks of the River Medway, approximately 2.5km east of Hoo St Werburgh village, and is centred on National Grid Reference TQ 810 725. The report forms part of a larger Environmental Statement and involves two elements: a desk-based assessment of the Study Area, including a walkover survey of the Site, and an assessment of its geoarchaeological potential, prepared by Chris Pine of Development Archaeology Services (see Appendix E4).

The site of the proposed new units and associated lay-down areas (Figure 3.10.2) are considered by Kent County Council (KCC) to be located within an area of archaeological potential. In response to this consideration, Environmental and Planning Management Ltd prepared a specification in 2003 (in connection with an earlier proposal at the site) for a desk-based assessment and walkover survey of the proposed development area. This archaeological desk based assessment is therefore intended to provide baseline historic environment data which will be used to assist KCC in the preparation of a response to the proposed development.

This desk-based assessment has been carried out in accordance with the specification prepared by Environmental and Planning Management Ltd, and with guidelines set out in the Institute of Field Archaeologists' *Standards and Guidance for Archaeological Desk Based Assessments* (IFA 1994).

3.10.3 Aims and Objectives of the Study

The general aim of the archaeological desk-based assessment is to gain information about the known and potential archaeological resource within the area of the application site, including its presence or absence, character and extent, date, integrity, state of preservation and relative quality in order to make an assessment of its worth.

This will contribute to the overall evaluation aim to provide sufficient information for planning purposes to enable:

(a) The formulation of a strategy to ensure the recording, preservation or management of any significant archaeological material; or
(b) The formulation of a strategy for further investigation, whether intrusive or not, where the character and value of the archaeological resource is not sufficiently defined to permit a mitigation strategy of other response to be devised.

The specific aims of this archaeological assessment are to identify and assess any known archaeological potential in terms of sites and/or deposits that may be affected by the proposed construction of units 5 and 6 within the area of the Kingsnorth power station complex, Hoo St Werburgh, Kent.

3.10.4 Planning Policy Guidance

Planning Policy Guidance on Archaeology and Planning (PPG 16) published in November 1990 consolidates advice to local planning authorities concerning the safeguarding of archaeology within the planning process. This guidance emphasises the irreplacability of the archaeological resource, which is a finite, non-renewable resource vulnerable to damage and destruction; details the role of archaeological records kept in County Sites and Monuments Records; encourages early consultation with local authority archaeological officers, and sets out the requirements for planning applicants to supply sufficient information about the potential impact of their proposals for reasonable planning decisions to be made. The document also indicates the circumstances in which further archaeological evaluation would be necessary to provide this information. The Kent County Sites and Monuments Record was consulted and entries were identified within the study area (Figure 3.10.10).

The stages of archaeological assessment, as suggested in PPG 16 are:

(a) Desk top (SMR study, aerial photographic (AP) study, documentary evidence) leading to the mapping of recorded remains, an assessment of the quality of the existing information and an initial grading of sites;
(b) Field evaluation (site walkover survey, systematic fieldwalking, geophysical survey) carried out on known archaeological sites and areas in order to upgrade data;
(c) Evaluation excavation (trial trenching, assessment of geotechnical tests) carried out prior to planning decisions in areas where the impact of the planning application is unclear;
(d) Mitigation procedures implemented following planning consent but prior to construction commencing or during the course of construction. This may include avoiding sites, protecting sites from damage by constructional methods, excavations undertaken to record archaeological remains before destruction, or watching brief maintained during construction works.

This report conforms to PPG 16 requirements to undertake an initial assessment of whether the application site is known, or likely to contain archaeological remains.

Planning Policy Guidance on Planning and the Historic Environment (PPG 15) published in September 1994 deals with Conservation Areas, listed buildings, World Heritage Sites, Historic Parks and Gardens, Historic Battlefields and the wider historic landscape. None of the PPG 15 categories would be affected by these proposals.

3.10.5 Listed Buildings and Scheduled Monuments

Statutory protection for archaeology is principally enshrined in the *Ancient Monuments and Archaeological Areas Act* (1979) as amended by the *National*

Heritage Act (1984). Nationally important archaeological sites are listed on a Schedule of Monuments, which is maintained by the Secretary of State for Culture, Media and Sport. Scheduled Monument (SM) consent is required for any development work that may affect the fabric of a scheduled monument. There are no scheduled monuments within the study area.

Listed Buildings are protected under the provision of Section 54(i) of the *Town and County Planning Act* (1971) as amended by the *Planning (Listed Buildings and Conservations Areas) Act* (1990), which empowers the Secretary of State for Culture, Media and Sport to maintain a list of built structures of historical or architectural significance. One listed building has been identified by this study as being located within the study area. This is the Grade II listed 17th century Lancers Farmhouse (Site No.59). Neither this building nor its setting would be affected by these proposals.

3.10.6 Methodology

This desk-based assessment has been carried out utilising a variety of cultural heritage data obtained from the following sources:

(i) the Kent County Sites and Monuments Record;
(ii) listed building information from the Department of the Environment greenbacks;
(iii) the Registers of Historic Parks and Gardens published by English Heritage;
(iv) the lists of Scheduled Monuments published by English Heritage;
(v) early edition Ordnance Survey maps from the Centre for Kentish Studies at Maidstone and the Strood Archives;
(vi) historical map information from the Centre for Kentish Studies;
(vii) published local historical information from the Centre for Kentish Studies; and
(viii) a walkover survey of the area of the application site.

Archaeological site information from the Kent County Sites and Monuments Record (SMR) was obtained within a 1.5 kilometre radius of national grid reference TQ 810 720. The SMR data is summarised in Appendix E1 of this report. Each of the SMR entries have been assigned unique site numbers from 1 onwards and are shown plotted on to Figure 3.10.10.

A search was conducted of the Department of the Environment greenbacks held at the National Monuments Record Centre, Swindon for the parish of Hoo St Werburgh. This information is also summarised in Appendix E2 and is shown on Figure 3.10.10. Each of the listed buildings identified in the vicinity of the application site have also been assigned unique site numbers.

The Registers of Historic Parks and Gardens and of Scheduled Monuments for the county of Kent were consulted at the National Monuments Record Centre, Swindon. No cultural heritage sites of either category were identified in the area of the application site.

Copies of historical map and early edition Ordnance Survey maps were obtained from the Centre for Kentish Studies at Maidstone and at the Strood Archives. These maps are reproduced as Figures 3.10.3 to 3.10.9 used in this study. These maps were used in a map regression study of the area of the application site, the results of which are presented in Section 3.10.9 of this chapter.

Published local historical data was obtained from the library of the Centre for Kentish Studies at Maidstone and is incorporated into the Archaeological and Historical section of this chapter.

An Archaeology South East archaeologist undertook a walkover survey of the area of the application site on Thursday 17th July 2003. The results of this site visit are presented in Section 3.10.8 of this chapter.

3.10.7 Geological and Topographical Background

The application site is situated on the southern side of the Hoo Peninsula and on the northern side of the estuary of the River Medway. The application site is situated on flat, low lying land at heights of between 2-3 metres AOD.

According to the assessment of geoarchaeological potential of the application site, prepared by Chris Pine of Development Archaeology Services (Appendix E4), the underlying bedrock in the area is London Clay, dating from the Eocene. Overlying this are drift deposits comprising mainly Pleistocene gravels to the north of the application site, which are in turn overlain by Holocene alluvial silts comprising clay silts and organic rich silts and peat deposits.

3.10.8 Results of the Site Walkover Survey

An Archaeology South East (ASE) archaeologist undertook a walkover survey of the area of the proposed new units on Thursday 17th July 2003, as part of a wider survey relating to the previously proposed FGD development site. The weather conditions were overcast but with good visibility.

The area scheduled for development was formerly the site of a sports ground (Figure 3.10.2), but is now under rough grass, grazed by horses. Although access to this extensive area was not possible in 2003, much of it was observed from adjacent tracks. It was noted that the area is crossed by a network of drainage ditches, and its overall ground level is lower than that of the surrounding area, which may be the result of former landscaping operations to raise the level of the north western approach road, and to create the earth bund and ditch along the northern edge of the Site. No features of archaeological interest were visible at ground level within the proposal area.

3.10.9 Map Regression Analysis

The earliest map available for this study is the tithe map for the parish of Hoo St Werburgh of 1839 (Figure 3.10.3). The Damhead Fleet is shown to extend much further westwards than it does today, and some attempts appear to have been made to defend the area from the surrounding waterways through the construction of earthen banks to act as flood defences. One such linear bank extends along much of the northern shoreline of the Medway estuary before turning north to follow the south eastern edge of Damhead Creek (Site No.61). A second earthwork extends along the north western edges of Damhead Creek (Site No.62). Other earthwork banks are also visible which may have acted as field boundaries (Site No.63).

Although the tithe map is in poor condition, it is possible to establish most of the apportionment details for the area that is now the power station. For those field numbers which can be discerned on this map, the accompanying tithe apportionment was consulted for details of field names, and these are listed in Appendix E1.

The field name and land use data reflect a low-lying, watery landscape, characterised by salt marshes and reed beds, and used predominantly for rough pasture. Few residential or other buildings are shown within and around the Site, although Teapot Hall (Site No.28) was clearly in existence within the area of the modern power station by this time.

Cartographic evidence also suggests that the landscape in and around the Site did not change significantly between 1839 and publication of the 1st Edition 6"-1 mile scale O.S. map of 1870 (Figure 3.10.4). This 19th century landscape is characterised by low-lying fields, drains and scattered homesteads or farmsteads, many of which were associated with small orchards, perhaps indicating the presence of a market garden relationship with larger cities and towns such as Gravesend, Rochester and London. These farmsteads include Kingsnorth, located to the north of the modern power station complex, and Burnt House on Jacobs Lane, located beyond the western corner of the application site.

Two further properties – Ashcote and Lancers - are depicted on Jacobs Lane, to the north west of the proposed development. Lancers Farmhouse (Site No.59), a 17th Century timber-framed structure, represents the only Grade II listed building in the study area. Teapot Hall (Site No.28) stood on the southern edge of the modern power station, on the northern banks of the estuary, although this structure does not survive today.

To the south of the Site, the Damhead Fleet appears to have extended westwards, across the area of the modern Kingsnorth power station. It is possible that the earthen bank, which constitutes Site No.63, marks this western extent of Damhead Fleet. A long, linear, E-W aligned earthwork (Site No.64) is also featured immediately to the north, crossing an area of marshland to the south of Burnt House. This was presumably intended to protect Burnt House and adjacent farmland from flooding at the western end of Damhead Fleet.

A large, sub-rectangular earthwork enclosure (Site No.48) is also depicted – for the first time - on the map of 1870, located south of Damhead Fleet, at the south eastern corner of the power station. This feature has been interpreted as a possible post-medieval salt bed or livestock enclosure, with a smaller enclosure, perhaps a sheepfold, located at its centre. An additional sheepfold is noted to the north of Damhead Fleet, which suggests that rough grazing was the predominant form of local contemporary land use.

Extracts from the Second Edition 25"-1 mile scale O.S. map of 1897 are reproduced in Figure 5. This map represents a more detailed version of the earlier 1870 edition, the only change being the partial drying out of Damhead Fleet, which is depicted as an area of marshland in 1897. Teapot Hall (Site No.28), the rectangular enclosure (Site No.48) as well as the sheepfold to the north of Damhead Fleet are all depicted.

The linear sea defences along the northern shore of the Medway estuary (Site No.61) are shown as a linear earthwork or bank.

The Third Edition 25”-1 mile scale O.S. map of 1909 is reproduced in Figure 6. The principal changes that have occurred since 1897 include the expansion of orchards, particularly across land to the north of Eshcol Road and the addition of a substantial earthen embankment running from north to south, to the north of the Damhead Fleet (Site No.65). This is marked on the 1909 map as the site of a railway under construction.

In 1961 the 1:10,000 scale O.S. map (Figure 3.10.7) indicates that the railway line had already become redundant: The embankment is still depicted, but the railway line now runs further north, linking the Isle of Grain in the east to Gravesend in the west. By this time an oil refinery had also been built north of the proposal area, and this was served by a railway link from the mainline and from the wharf, located to the east at Damhead Creek. A large building, subsequently known as Holm Lodge (Site No.70), is also visible on the 1961 map, located west of the industrial site on the other side of the disused railway embankment. In the south, on the site of the modern power station, three small unidentified buildings are located to the north west of Teapot Hall (Site No.28).

The Kingsnorth power station (Site No.3) makes its first appearance on the 1:50,000 scale O.S. map of 1974 (Figure 3.10.8). The approach road, accessing the north west corner of the site from Eshcol Road, is shown in its current position, with overhead power cables and pylons also marked. A substantial earth bank had been raised along the northern edge of the power station, and this is still in existence along the northern edge of the Site. Three long jetties had also been constructed around the coastline, projecting into the navigable reaches of the Medway estuary: one projecting south from the power station; another, the Oakham Ness Jetty, extending east from the Hoo Peninsular, joining Oakham Marsh island to the mainland, and the Bee Ness Jetty extending a considerable distance from the coastline north of the refinery wharf. The western extent of Damhead Fleet had been shortened and the land reclaimed for construction of the power station. Teapot Hall (Site No.28) was presumably demolished when the power station and associated jetty were constructed in the 1960s. The rectangular shaped enclosure (Site No.48) is not marked on this map although an area void of buildings within the power station is depicted where this was once located.

On the 1:10,000 scale O.S. map of 1995 (Figure 3.10.9), the power station complex is enclosed by earthworks to the north and west; with Damhead Creek to the east, and the flood defences of the Medway coastline on its southern side. Barrack-type accommodation is also marked on the map as the site of a hostel, situated alongside the approach road at the north west corner the power station.

The 1:5000 scale site plan of 2006 (Figure 3.10.2) shows the layout of the present power station complex, and includes the Damhead Creek power station situated between the northern edge of the Kingsnorth complex and the Industrial Estate to the north.

3.10.10 Archaeological and Historical Background

An assessment of the geoarchaeological potential of the area of the application site, prepared by Chris Pine of Development Archaeology Services, concluded that Holocene alluvial silts may overlie this area. These may mainly consist of alluvial gravels; sands and silts intermixed with organically rich silts and discrete peat horizons. There may be potential for archaeological material originating from interglacial periods of deposition i.e. the Palaeolithic to exist beneath the application site within distinct archaeological horizons within the Holocene deposits. This assessment also concluded that these alluvial deposits, which were laid down in temperate and interglacial periods are minimally considered to be of national importance.

Recent palaeoenvironmental analysis of material recovered from borehole investigations to the immediate north of the application site at Kingsnorth indicated that organic sediments within the sequence of deposition at the site may have originated form a palaeochannel and that the potential may exist for similar such activity to be encountered within the area of the application site.

Archaeological periods represented

The time-scales of the archaeological periods referred to in this report are given below. The periods are given their usual titles. It should be noted that for most cultural purposes the boundaries between them are not sharply distinguished, even where definite dates based on historical events are used. Subdivisions within periods are not considered separately.

Prehistoric: Palaeolithic	(*c*. 500,000 BC – *c.*10.000 BC)
Prehistoric: Mesolithic	(*c*. 10,000 BC – *c.* 4,300BC)
Prehistoric: Neolithic	(*c*. 4,300 BC – *c.* 2,300BC)
Prehistoric: Bronze Age	(*c.* 2,300 BC – *c.* 600 BC)
Prehistoric: Iron Age	(*c.* 600 BC – *c.* AD 43)
Romano-British	(*c.* AD 43 – *c.* AD 410)
Anglo-Saxon	(AD 410 – AD 1066)
Medieval	(AD 1066 – AD 1485)
Post-medieval	(AD 1486 - 1900)
Modern	(AD 1901 to present day)

Prehistoric Period

In June-July 1998 Archaeology South East undertook an archaeological evaluation prior to the construction of the Damhead Creek power station, on land to the north of the proposed new units (Site Nos. 47 and 51). The evaluation comprised a series of nine trenches, seven of which were devoid of archaeological features. Overall the trenches revealed Pleistocene sands and gravels in the eastern portion of the site and clayey sites to the south and west. These fluvial deposits were in turn overlain by Holocene silts and alluvial clays of late prehistoric to modern date. Two of the evaluation trenches yielded three archaeological features, which comprised one linear feature and two pits. All three features produced burnt clay, while one of the

pits produced worked flint, two iron objects, animal bone, two fragments of quern stone and two sherds of probable late prehistoric pottery.

This evaluation had been preceded by an archaeological watching brief in May-June 1998, which was also undertaken by Archaeology South East (Site No.7). This took place along the route of a proposed access road to the Damhead Creek power station. However this did not locate any archaeological features and only found a scatter of undiagnostic pieces of worked flint and pottery.

This evaluation and watching brief (Site Nos. 7, 47 and 51) represented the first phase of a much larger and subsequent programme of archaeological investigation which took place in the same area and in advance of the construction of the Damhead Creek power station (Site No.66). These archaeological watching briefs and localised excavations found evidence for multi-period settlement activity, which commenced in the Bronze Age. Bronze Age settlement features included a possible drove way and a cremation burial. Later prehistoric features were also encountered which included field divisions and other settlement features.

In July 2001 Archaeology South East undertook a second archaeological evaluation (Site No.60) in advance of the excavation of a system of new balancing ponds adjacent to the Damhead Creek power station. Eight trenches yielded a series of late prehistoric ditches, or gullies, and postholes. This evaluation area, which is also located immediately north of the proposed new units, was subsequently subjected to a full area excavation, which was also undertaken by Archaeology South East in 2001-2 (Site No.60). This excavation located evidence for multi-period prehistoric activity from the Neolithic onwards. A single sherd of Neolithic pottery was found along with a large number of mid-late Bronze Age pits and postholes. Iron Age settlement activity was also located comprising pits, postholes and ditches.

Evidence for other prehistoric activity in the area includes the possible remains of a late prehistoric timber trackway, found in 1999 during a survey of intertidal sites undertaken by the Upchurch Archaeological Research Group (Site No.11).

Romano-British

The Phase 2 programme of archaeological watching briefs and localised excavations were undertaken by Archaeology South East between 1998-9, on the site of the previously proposed Damhead Creek power station (Site No.66). The most significant discovery was an important 1st-4th century AD pottery manufacturing site producing flagons, lagens and amphora. However, despite the presence of large amounts of kiln furniture, no intact kilns were located, although a geophysical survey (also undertaken as part of this programme) suggested the presence of several kilns in the immediate vicinity.

A further archaeological evaluation undertaken to the north of the current application site (Site No.60), also located a large clay extraction pit associated with the Upchurch Ware Roman pottery industry. This evaluation was followed by full excavation of the area in 2001-2, which yielded further evidence of Romano-British settlement activity in the form of pits and enclosure ditches.

In 1999, the Upchurch Archaeological Research Group identified a number of Roman salt manufacturing sites in the surrounding area, located on islets in the middle of the Medway Estuary. These include the site of a mid first century AD salt manufactory (Site No.50), which contained salt winning debris, evidence of firing areas, portable furniture and light structures. Nearby, a second, contemporary site (Site No.4), retained the fragmentary remains of wooden hurdle tracks, adjoining timber structures and other artefacts, including pottery and bone.

Two further industrial sites, of 1st-2nd century date, were also identified in the vicinity (Site Nos.5 and 6): Evidence recovered from Site No.5 suggests that salt production and pottery manufacture were taking place on the same site, and significant deposits were recorded at Site No.6, including a first century ditch, postholes and salt winning debris, as well as a substantial scatter of 1st-2nd century AD pottery.

Additional scatters of 1st-2nd century pottery were found in the area (Site No.17), as well as burnt soil horizons of Roman date (Site No.14), identified nearby on the edge of a salting.

On the northern shoreline of the island of Darnet Ness a late 1st-early 2nd century jar was found in 1865 (site No. 8). Evidence of Romano-British saltern debris and pottery in the Hoo Saltings (Site No.12), to the west of the power station, were found in 1965 by a Mr O'Cock, along with further Roman pottery sherds (Site No.18). In the same area – the Hoo Saltings - the Upchurch Archaeological Research Group located 1st-2nd century occupation deposits including a ditch or channel and 1st century pottery (Site No.11) during a survey of intertidal sites in the area.

In 1975 Roman pottery and briquetage were found during the construction of a jetty for the Kingsnorth power station (Site No.10).

Anglo-Saxon

The parish of Hoo St Werburgh is named after the dedication of the church to the Saxon princess Werburg, daughter of Wulfhere, king of Mercia (Farmer 1997: 503). The parish of St Werburgh, along with some of the adjoining parishes, belonged to the Hundred of Hoo - a *hundred* being a Saxon territorial division comprising ten *tithings*, or 100 households (Cottle 2006) – and is listed in the Domesday Book of 1086.

Hoo St Werburgh was also one of the early minsters, founded in Kent before 700 AD and, although the nunnery was destroyed in circa 800 AD, Hoo continued to serve as a minster (Clarke 2006).

The place names `hoo' and `kingsnorth' also appear to be of Saxon derivation: the Old English *hoh* meaning `(place at) the spur of land' (Mills 1991: 177), and cy*ning snad* denoting a `detached piece of land or wood belonging to the king' (Mills 1991: 197).

An alternative interpretation of the place name of Kingsnorth is derived from the late Anglo-Saxon period when contemporary Jutish settlers would have been known as a *Kyn, Kin* or *Cyn* meaning a family grouping. They would have resided on higher ground or on a *nod* or knoll above the then surrounding marshy ground (Glover 1976: 112).

Archaeological investigations undertaken by Archaeology South East between 1998-9 on the site of the Damhead Creek power station and to the immediate north of the application area (Site No.66), identified sporadic Anglo-Saxon settlement activity which comprised a number of pits, postholes and gullies.

Medieval

The archaeological investigations of 1998-9, undertaken by Archaeology South East on land to the north of the Site (Site No.66), located one sherd of unstratified 15th century pottery.

The site of a 13th-14th century firing area and the remains of a timber landing stage (Site No.15) were found by the Upchurch Archaeological Research Group in 1999 on an islet in the middle of the Medway Estuary.

Post Medieval

Lancer's Farmhouse (Site No.59) is a 17th century, Grade II listed former farmhouse situated on the eastern side of Jacob's Lane, to the north west of the power station complex. The site of a possible post medieval mound is situated in Bishop's Marsh (Site No.36).

The First Edition 6"-1 mile scale O.S. map of 1870 (Figure 4) details the remains of a sea wall (Site No.21) enclosing fields between Damhead Creek and the Medway Estuary. This map - and the 1839 tithe map - also feature the site of the former

Teapot Hall (Site No.28) depicted as a building surrounded by an embankment or sea defence.

The 1870 O.S. map also features the site of a former cement works (Site No.42), located south of the power station, on the island of Darnet Ness. The same map also features the site of Beer House (Site No.43) also on the island of Darnet Ness and the Hardway Path (Site No.44) south west of the power station. These three sites are not shown on Figure 4 (1870 O.S. map).

Also on the island of Darnet Ness is Darnet Fort (Site No.9), a circular fortress constructed in 1870 as part of a chain of defences protecting the Medway estuary. The fort was completed and operational by 1872 and was finally disarmed and abandoned prior to the First World War. To the north east of the application site, a post medieval wharf is shown on the Second Edition 25"-1 mile scale O.S. map (Site no. 45) within Damhead Creek. To the east of this is a circular shaped embanked feature (Site No.46) also shown on the same O.S. map. Neither of these sites are shown on Figure 5 in this study. On the same O.S. map of 1893 and also depicted on Figure 5 is a rectangular shaped enclosure of probable post medieval origin (Site No.48) located within the confines of the modern power station complex.

20th Century

The line of a submerged telephone cable (Site No.37) is featured on a chart of the Medway dated to 1910 and to the west of the Kingsnorth Industrial Estate. The "Medway Queen" (Site No.38) a former paddle steamer constructed in 1924 on the River Clyde is berthed on the northern shore of the Medway.

In 1912 two British naval officers were sent to Germany in order to study that country's progress in airship development. Such was the progress in this field that the Germans were making that the British could not ignore these significant advances for long. This was to have a significant influence on British defence plans. This influence together with the report on Germany's technological advances in this field led directly to the construction of a new airship shed, which was sited on the north bank of the River Medway at Kingsnorth (Site No.13). The airship shed was to be operated by the Admiralty. Construction work at Kingsnorth started in July 1913 and was finished by June 1914. By 1915 and with the First World War well under way the Admiralty found itself confronted by a very serious run of events in the naval war. During the early part of that year increasing numbers of U-boats had been entering the English Channel and were sinking increasing numbers of Allied shipping.

In order to counter this increasing submarine menace Kingsnorth was given the task of designing and constructing a new airship known as the Submarine Scout. The objectives of these airships were to observe and locate enemy submarine activity. The first of such airships undertook its maiden flight in March 1915.

During the remaining years of the First World War Kingsnorth became the very centre of British airship development. Not only was a very great deal of experimental work carried out here but also a considerable number of airship pilots were given their basic training here. The airship station (Site No.13) was also of very considerable importance to the local economy employing large numbers of local

civilians in such activities as fabric working. As the First World War progressed so did the size of the Kingsnorth airship station. To the initial airship shed constructed between 1913-14, a second and large shed was subsequently added. Buildings for the manufacture of airships were also constructed along with experimental laboratories and a large power house. Also attached to the site was a special railway and a riverside pier, which were both used for the transit of heavy materials. The Submarine Scout was followed by the larger Coastal or Type C airship and later by the North Sea Type, which was used for fleet reconnaissance.

In the years following the First World War defence economies became the order of the day. In 1920 the Kingsnorth airship station (Site No.13) was finally closed with all experimental development work being transferred to Cardington in Bedfordshire. The site of the former Kingsnorth Airship Station (Site No.13) is now occupied by a modern industrial estate to the north of the power station complex. For a number of years after this the Kingsnorth site remained abandoned until 1930 when the 323-acre site was purchased by the oil refining company of Berry Wiggins including the buildings, river pier and internal railway. The oil company at first made extensive usage of these facilities before replacing the river pier in 1937 with the much longer Bee Ness Jetty. In 1940 the internal railway was abandoned and the rails used for scrap in the war effort of the Second World War. Finally in 1964 work started on the Oakham Ness Jetty, which finally came into operation in 1967.

The archaeological excavations undertaken by Archaeology South East in 1998-9 on the site of the Damhead Creek power station (Site No.66), and north of the current proposal area, located building remains associated with the former airship station. These included the remains of one of the airship hangers. The map regression exercise (see Section 3.10.9) also identified the remains of an additional building, Holm Lodge (Site No.70), within this area. The house was in existence during the mid-20th century, although its exact date of construction and demolition have not been verified.

By the early 1960s this area of the Hoo Peninsula was becoming increasingly heavily industrialised. Along with the existing Berry Wiggins oil refinery came the construction in the early 1960s of the present Kingsnorth power station by the Central Electricity Generating Board. The power station (Site No.3) was constructed between 1963-73 as one of some ten 2000-megawatt electricity-generating stations during that period. There are both coal and oil options within the complex. There are two large jetties in the River Medway for both colliers and oil tankers. Coal-fired generation was the sole power source after 1978. In addition there is a back-up gas turbine station. The Kent Sites and Monuments Record notes the site of a former military installation within the power station complex (Site No.24).

The remains of an abandoned jetty of possible modern origin are located on the south western foreshore of Darnet Ness (Site No.19). The remains of various undated barges (Site No.32) are situated on the northern foreshore of the Medway estuary and adjacent to Damhead Creek. Situated in the same area are the remains of a post medieval or modern barge (Site No.33). An unidentified and derelict barge (Site No.34) is situated in the same vicinity. An unidentified hulk of possible post medieval or modern origin (Site No.40) is located on the northern shoreline of the Medway and to the west of the power station.

The Kent Sites and Monuments Record notes a number of additional remains of the unidentified remains of barges (Site nos.52-58), which probably post date the Second World War and which are all located as a distinctive grouping in the same area as Sites 32-34. The Third Edition 25”-1 mile scale O.S. map of 1909 shows the site of a wharf (Site No.49) on the northern shoreline to the west of the power station (not featured on Figure 6). The site of an abandoned landing stage has been located on the western shore of Darnet Ness (Site No.20).

Sites of Uncertain Origin

There are a number of potential archaeological sites within the vicinity of the application site which cannot be ascribed to any particular historical period and for which there is also an uncertain function or purpose. A large proportion of these potential sites have been identified through prior aerial photographic interpretation.

Situated to the south west of the power station complex and on the northern foreshore of the estuary is the site of the possible remains of an unidentified craft of some 60 metres in length (Site No.1). The remains of four unidentified barges are situated on the western shire of Darnet Ness in the Medway estuary (Site No.2). Undated timber fragments have been found on the southern foreshore of Darnet Ness by the Upchurch Archaeological Research Group (Site No.16).

The remains of an undated building situated to either side of a trackway are located to the east of the Kingsnorth Industrial Estate (Site No.22). The Second Edition 25”-1 mile scale OS map of 1897 (Figure 5) features an undated square shaped feature cut into the surrounding saltmarsh (Site No.23). An undated landing stage is situated on the foreshore to the immediate south of the power station complex (Site No.25). An undated possible square shaped enclosure (Site No.26) has been identified from aerial photographic interpretation to the immediate east of the power station. Undated former sea defences (Site No.27) comprising a series of roughly north-south orientated earthen banks are situated to the west of the power station complex.

A possible undated enclosure, featured on the First, Second and Third Edition O.S. (Figures 4-6) was situated to the immediate north east of the power station (Site No.29). The site of an undated fish weir (Site No.30) is situated on the northern foreshore of the Medway and to the west of the power station. The site of an undated possible salt works (Site No.31) has been identified from aerial photographic sources and is situated to the west of the power station.

The site of a possible undated ring ditch plotted from aerial photographs (Site No.35) is situated within the southern area of the power station complex. An undated strandline (Site No.39) is located on the northern shore of the Medway and to the immediate south of the power station complex. An undated and circular shaped embanked feature (Site No.41) is located to the immediate south west of the power station.

3.10.11 Conclusions and Recommendations

Two earthwork features have been identified within the area of the proposed development – a possible, undated enclosure (Site No. 29), located in the south eastern corner of the site and a north-south aligned linear earthwork at the western end of the development area (Site No. 65), thought to be the remains of a former railway embankment. The site of Holm Lodge (Site No. 70) is also located within the proposed lay-down area to the north. These features may therefore be directly affected by the proposed construction activities.

This study has found evidence for significant past human activity within the Study Area, including multi-period settlement remains dating from the Bronze Age to the present. Direct evidence for such activity has not been found within the proposed development area, although the wealth of sites and finds in the immediate area increases the potential of the Site to contain previously unknown archaeological remains, including those buried deep beneath alluvial silts: The accompanying geoarchaeological assessment (Appendix E4) to this study concluded that there may be potential for early prehistoric archaeological material to be present amongst the Holocene alluvial silts and peat horizons underlying the application site. The recent borehole investigations which took place to the immediate north of the application site and in connection with a previous application for construction of the Damhead Creek power station also indicated the presence of possible palaeochannels through deposition patterns revealed in the borehole logs. It is possible that similar features may occur underlying the application site.

Other known cultural heritage sites, located south of the application site, within the boundary of the existing Kingsnorth power station, include: structural features associated with the site of the World War II military installation (Site No.24); undated and post medieval enclosures (Site Nos. 26 and 48); the site of the former Teapot Hall (Site No.28) and the anti-flood embankments (Site Nos. 61-64). These sites appear to be unaffected by the present development proposals, but there is a potential that they may be affected by future operations associated with - or resulting from - the development of the proposed new units 5 and 6, such as the possible construction of access tracks or the demolition of existing buildings and subsequent levelling of the site.

Recommendations for Further Work

The site of the proposed new units 5 and 6 (Figure 3.10.2) possesses a high potential for the survival of significant archaeological deposits, particularly considering the range of evidence identified during the course of archaeological investigations within the adjacent area (Site Nos. 7, 47, 51, 60 and 66). However, at this stage, there is insufficient information about the nature, extent and condition of known and as yet unknown archaeological deposits within the Site to fully assess the impact the proposed development will have on them.

A mitigation strategy will be developed to ensure that during construction, care will be taken to identify any archaeological remains discovered so that investigations can be carried out in parallel with the development and construction the new units.

BIBLIOGRAPHY

Clarke, J. 2006. Church of St Werburgh. Available on-line at: http://ads.ahds.ac.uk/catalogue/search.

Cottle, G.P. 2006. Hoo St Werburgh Parish. Available on-line at: www.werburgh.co.uk/entry/content/history/history02.htm.

Farmer, D. 1997. *The Oxford Dictionary of Saints.* Oxford University Press: Oxford.

Glover, J. 1976. *The Place Names of Kent*. Batsford: London

Griffin, N. 2002. *A Post Excavation Assessment of Archaeological Investigation at the Damhead Creek Power Station Exclusion Area,* Archaeology South East project No.1129.

Hasteds, E. 1799-1801. *The History and Topographical Survey of the County of Kent*.

Institute of Field Archaeologists. 1994. *Standards and Guidance for Archaeological Desk-based Assessments.* Manchester.

Ireland, L.H. 1829. *History of the County of Kent,* Vol.2: 387.

James, R. 2001. *An Archaeological Evaluation at Damhead Creek Power Station Habitat Exclusion Area, Kingsnorth, Kent,* Archaeology South East Project No.1129.

Johnson, C. 1998. *An Archaeological Evaluation and Watching Brief of Land at the Site of the Proposed Kingsnorth Power Station, Hoo St Werburgh, Kent,* Archaeology South East project No.905.

Johnson, C. 1999. *An Archaeological Post Excavation Assessment of Damhead Creek, Kingsnorth Power Station and Associated Works, Hoo St Werburgh, Kent,* Archaeology South East Project No.1001.

Mills, A.D. 1991. *A Dictionary of English Place-Names.* Oxford University Press.

3.11 Contaminated Land

Ground Investigation results are available from 3 boreholes and 5 trial pits underlying the proposed development of units 5 & 6 at Kingsnorth.

Laboratory analyses of 11 soil samples from these locations were tested for a range of determinants typically associated with power station land, the results of which are summarised in the table below.

Table 3.11.1: Summary of Soil Analyses, proposed Units 5 & 6

Determinant	Kingsnorth Results (mg/kg)			SGV for Commercial Use (mg/kg)
	Minimum	Mean	Maximum	
Arsenic	8.5	24	64	500
Boron	23	56	110	
Barium	54	210	690	
Beryllium	<0.5	1.5	4.2	
Cadmium	<1	N/A*	8.9	1400
Chromium	37	58	76	5000
Copper	13	54	150	
Mercury	0.03	0.17	0.52	480
Lead	7	91	440	750
Nickel	20	55	120	5000
Selenium	0.23	1.2	3.4	8000
Vanadium	46	150	340	
Zinc	86	170	400	
Sulphate	160	1200	3200	
pH	5.3	7.7	8.8	
PAH**	<1	N/A*	5	

Notes
All values quoted to 2 significant figures
* *Mean not calculated due to multiple results below detection limits*
** *Polyaromatic Hydrocarbons*

No test results show contaminants in excess of relevant Soil Guideline Value concentrations for commercial sites, as currently available in the CLEA documents published by DEFRA.

The relatively high concentrations of sulphate indicate that concrete requirements for foundation construction should be assessed in accordance with BRE Special Digest Publication 1 to ensure resistance to chemical corrosion.

Risks to construction workers will be dependent on the nature of construction activities, in particular the degree and duration of exposure to soils. Construction works will be undertaken in accordance with Health and Safety risk assessments that will include site rules on personal protective equipment, personal hygiene and emergency procedures.

Borehole and trial pit records from across the entire Kingsnorth site indicate widespread low permeability soils, comprising Made Ground overlying Alluvial Clay. It is therefore considered highly unlikely that lateral migration of contamination to or from adjacent areas is a significant factor for the proposed development.

Current and Present Use

The area identified for Units 5 and 6 is currently rough pasture/grassland, crossed by several stock-proof fences (post and wire) and reportedly used for grazing horses at periods throughout the year. The site perimeter is fenced with a post and wire stock-proof fence. The site investigation, although limited in extent, indicates the

centre of the site as containing 'natural' materials only. Drilling in the south east of the Horse Fields, and trial pitting at the eastern boundary indicates the presence of Made Ground ash, brick and rock and clayey material.

Made Ground is also indicated outside of the Horse Fields to the south and west. It is concluded therefore that parts of the site have been used for other purposes including some tipping to raise levels in the past.

The area in the north east part of the site was used for agriculture up to 1938 Where the first building can been seen on the Envirocheck sheets this building is later shown to be Kingsnorth House. There is no further construction on the site until the appearance of a hostel in the south of the site and sea defences along the boundary of most of the site in 1971. The only further change on site is the replacement of Kingsnorth house with Holm Lodge.

There is no industrial activity on site. However, the oil refinery has been constructed right up to the North east boundary since the 1971 Envirocheck sheet.

Surface Water Drainage and Flood Risk

Rainfall

Long-term average rainfall in this part of Kent is variously estimated as 543 mm/a (Meteorological Office, MORECS data for square 163, 1961 to 1985), 752 mm/a (Medway catchment to the gauging station at Teston, 1961 to 1990), 729 mm (Darent catchment to the gauging station at Hawley, 1961 to 1990).

Existing Surface Water Drainage

The site plan (Figure 2.1.1) shows drainage ditches located on three of the four sides of the proposed units 5 and 6, on the north, south and east sides. The ditches are approximately 1.5 to 2.0 m deep.

It is assumed that any current surface water drainage from the proposed disposal area is via this ditch. However, surface flows are likely to be limited due to the flat lying ground. Flow to the north and west is prevented by the flood protection bund.

Flood Risk

The Environment Agency's indicative flood risk map (examined on 1 July 2003) suggests that the site is at risk of flooding by the sea. However, the power station site, including Horse Fields, is protected by an Environment Agency flood protection bund.

Surface Water Abstractions

Details of licensed surface water abstractions were obtained from the Environment Agency within a 5 km radius of the site.

There are fourteen surface water abstraction licenses within 5 km of the site. The closest surface water abstraction to the site is from the River Medway (9/40/02/0067/SR), licensed to E.ON UK for Industrial Cooling. The remainder are typically from marsh ditches and drains, unnamed watercourses and unnamed lakes, all located at least 1 km from the site.

Surface Water Discharge Consents

Details of consented discharges within a 3 km radius of the site were obtained from the Environment Agency.

Kingsnorth power station holds one consent to discharge under its IPC authorisation (number AA3000), which includes cooling water, water treatment plant effluent, boiler blowdown, screen flushing water, ash lagoons discharges, site drains and treated sewage effluent.

Surface Water Quality

Regional
The Medway Estuary at Gillingham Strand located downstream (east) of the site, and Oakham Ness located upstream of the site are classified as A (good quality) under The National Water Quality Tidal Classification 1995.

Site
No surface water quality data for the site has been made available.
Surface water drainage from the site passes through various traps before discharging to the attenuation structure. It is further reported that the only restriction on discharge is that there should be no visible oil.

Geology

Sources of Information

Information on the geology of the area of Units 5 and 6 has been taken from:

The geological map of the area (BGS 1977, 1:50 000, Sheet 272, drift edition);
Limited site investigation information provided by E.ON UK. (Selected borehole and trial pit logs, location plan and limited analytical data from CJ Associates Report (dated early 2003) and borehole logs and location plan for 5 boreholes drilled by Wimpey Laboratories in September 1987 and 2 drilled in 1988.

Regional Geology

The geological map indicates that the site and immediate surrounding area is underlain by Alluvium, with River Gravel deposits located to the north and west of the site. The Solid geology is identified as London Clay, underlain by the Woolwich Beds and Thanet Beds, which in turn are underlain by Upper Chalk. A geological cross section approximately 8 km west of the site indicates bedrock is gently undulating. However, there is no information to indicate the dip of bedrock in the vicinity of the site. The map does not indicate the presence of faulting in the vicinity of the site.

The London Clay comprises blue shaley clay, with laminated silty clay and loam, and is indicated to be up to 137 m in thickness on the geological map. The underlying Woolwich Beds (sands and clays) and the Thanet Beds (sands) are indicated to be up to 18 m and 24 m in thickness respectively. The Upper Cretaceous Chalk is shown to be about 91 m thick in the region by the geological map, however it is suggested that it may range between 170 m and 240 m thick below the site (ERM, 1996). It is described as being mainly soft, fine-grained and highly fissured with nodules and flint layers (ERM, 1996).

Hydrogeology

Sources of Information

Information on the hydrogeological setting has been considered from:

- Borehole logs provided by E.ON UK that contain information on water strikes;
- Environment Agency records of licensed abstractions;
- Hydrogeological Map of the Chalk and Lower Greensand of Kent (IGS, 1970);
- Groundwater Vulnerability Map (Environment Agency, 1995).

Groundwater Vulnerability

The Groundwater Vulnerability Map (Environment Agency, 1995) identifies the area of Kingsnorth power station as a Non-Aquifer of negligible permeability, reflecting the presence of the Alluvium and London Clay.

The notes on the map describe the underlying Chalk as a major aquifer and the Thanet Sands and Terrace Gravels as minor aquifers.

The presence of the overlying low permeability material gives a degree of protection from surface contamination, and therefore the site has been classified as low vulnerability in terms of groundwater.

Groundwater Units

The geology beneath the site consists of low permeability (clays and silts) and higher permeability (sands and gravels) units. It is likely that the higher permeability layers will act as aquifers and the intervening low permeability layers as aquitards. This will impart a strong horizontal direction to groundwater flow, with limited vertical movement. The aquitards will restrict groundwater movement between aquifers.

From the borehole evidence, the Terrace Gravel appears to be a confined aquifer, and is probably laterally continuous. Groundwater was intersected in most of the boreholes listed in Table 3.11.2 at or near the interface between the Terrace Gravel and the Alluvium. In several boreholes the groundwater rose to a level above the top of the gravel, indicating that the aquifer is confined. As drilling advanced, the groundwater was subsequently cut-off as casing was installed through the gravel and drilling progressed in the London Clay.

The deeper boreholes indicate that the sand units beneath the initial clay band of the London Clay are strongly confined. No groundwater was reported in the clay unit, but water strikes at or near the interface between the clay and underlying sand rose by over 10 m in some cases.

Table 3.11.2 Record of Water Strikes

Borehole / Trial Pit	Water Strikes (m bgl)	(m AOD)	Unit	Observations
BH6:	4.0	N/A	Sand (Terrace Gravels?)	Water struck, no rise
BH10A:	5.0	N/A	Very sandy clay (Alluvium)	rose to 4.5 m after 20 minutes
TP6	1.8	N/A	Made ground	
BH901	3.5	-3.23	Alluvium	rose to 3.4 m after 20 minutes, cut-off at 4.5 m
	6.5	-3.27	Alluvium	rose to 5.8 m after 20 minutes cut-off at 7.5 m
	18.2	-14.97	near top of sand underlying London Clay	rose to 5.6 m after 20 minutes
BH902	3.5	0.3	Alluvium	rose to 3.4 m after 20 minutes
	10.9	-7.1	London Clay	
	17.7	-13.9	top of sand	rose to 6.4 m in 20 minutes
BH904	3.5	-1.1	Terrace Gravel	rose to 2.4 m after 20 minutes, cut-off at 5.5 m.
	16.0	-13.6	top of sand	slight seepage
	24.5	-22.1	sand	
BH905	4.5	-2.16	Alluvium	rose to 2.8 m after 20 minutes
	13.5	-11.16	top of sand	rose to 7.9 m after 30 minutes
BH932	4.70	N/A	Alluvium	Water struck at 4.50m rose to 2.1m is 20 minutes groundwater cut off by casing at 7.00m
BH032A	3.50	N/A	Terrace gravel	Water struck At 3.50m rose to 2.00m in 20 minutes.
	17.60	N/A	Top of sand underlying London Clay	Water struck at 17.60m rose to 6.90m in 20 minutes.
BH901	3.50	N/A	Alluvium	Water struck at 3.50m rose to 3.40m in 20 minutes, water was still riseing after 20 minutes. groundwater was cutoff by advanceing the casing at 4.50m.
	6.50	N/A	Terrace gravel	Water struck at 6.50m rose to 5.80m in 20 minutes. Water level still riseing after 20 minutes. Groundwater was cutoff by advanceing the casing at 7.50m
	18.20	N/A	Top of sand underlying London Clay	Water struck at 18.20m rose to 5.60m in 20 minutes, water was still riseing after 20 minutes.

Groundwater Levels and Flow

Groundwater levels across the whole power station were monitored on May 16th 2003. The results of these demonstrated the following:-

- Groundwater in the granular deposits (mainly River Terrace sand and gravel, with some alluvial sand) underlying the alluvial clay is confined.
- The piezometric surface of this confined groundwater shows up to 1.8m of variation due to tidal influence.
- The apparent static nature of groundwater level in BH8 and OBH3 could be due to localised factors such as sea wall or other artificial structures.
- The high water level in BH1 could be due to the ash lagoons acting as a zone of recharge to the groundwater.
- Low tide water levels in the remaining boreholes are consistent with a broad hydraulic gradient towards the estuary.

Deeper groundwater, in the Chalk is shown (IGS, 1970) to have a general flow to the northeast with local depressions around significant groundwater abstractions, which will act as groundwater discharge points. The piezometric level in the Chalk is shown to be around -25 ft AOD (-8.2 m AOD), which is well above the projected top of the Chalk show as ~ -200 ft AOD, -66 m AOD.

Groundwater Abstractions

Details of licensed groundwater abstractions within a search grid ranging from TQ 76 67 to TQ 86 77 have been obtained from the Environment Agency. Locations of these licensed abstractions that lie to the north of the Medway Estuary are presented in Table 3.11.3.

Within the search area, and north of the Medway, there are five licensed groundwater abstractions from drift and gravel deposits, for spray irrigation purposes. The closest abstraction to the site is approximately 0.7 km west of the site (Licence 9/40/02/0254) and is, licensed to abstract a total of 90 000 m^3/annum from a combination of drift and an unnamed watercourse (probably a ditch). The next closest is located approximately 1.6 km west south west of the site (Licence 9/40/02/0011/GR) and licensed to abstract 18 438.6 m^3/annum from drift. None of the five abstractions are located directly down assumed-hydraulic gradient of the proposed supercritical coal plant area.

Two licensed groundwater abstractions are from the Chalk. One is located on Kingsnorth Industrial Estate (Licence 9/40/02/0019/GR) just north west of the power station, and the other Licence (9/40/02/0243/G) is for 9 boreholes between Kingsnorth and Grain licensed to E.ON UK.

Table 3.11.3 Details of Licensed Groundwater Abstractions

Licence No	Licence Holder	Site Name	Use	Annual Licensed Quantity (m^3)	Ground water Unit	NGR	Distance from Horse Fields (TQ 810 725) (km)
Shallow Groundwater							
01/118	E Smith and Sons	New Hall Farm, Allhallows	Spray Irr	4546	Gravels	TQ 8290 7693	4.9
01/132	RF Baker & DJ Baker	Clinch Street Farm, Rochester	Spray Irr	4546	River Gravels	TQ 7908 7595	3.9
9/40/02/0 011/GR	W.ST.J Brice Ltd	Cockham Farm, Hoo	Spray Irr	18439	S (sandy ?) Drift	TQ 7946 7196	1.6
9/40/02/0 254	PA Sawday	Ditch at Kingsnorth	Spray Irr	90000	Drift & watercourse	TQ 8030 7260	0.7
9/40/02/0 255/G	PA Sawday	Tile Barn Farm, Hoo	Spray Irr	45460	Claygate Beds and drift	TQ 7879 7318	2.3
Chalk							
9/40/02/0 019/GR	Damhead Creek Ltd.	Kingsnorth	Ind / Ind Cooling	638494	Chalk	TQ 8075 7298	0.5
9/40/02/0 243/G	E.ON UK	Nine boreholes between Kingsnorth and Grain	Ind.	1889835	Chalk	TQ 7750 7386	variable

Note: Details supplied by the Environment Agency for a rectangular area with SW corner at TQ 76 67, 10 km East and 10 km North.

Groundwater Quality

Groundwater contamination testing was monitored in 2003 across the whole power station.

The results from some of the trial pits illustrates the relatively high concentration of some contaminants (List II substances as specified by the Groundwater Regulations) detected in TP6, excavated in the former tip to the north of Damhead Creek, with several determinants exceeding DWS values by between 2 and 5 orders of magnitude.

Key results of the groundwater analyses include:

- All groundwater samples show highly elevated concentrations of chloride and sodium.
- No visible hydrocarbons were noted in purged groundwater samples taken from the 'Tank Farm' boreholes during May 2003 and similarly subsequent laboratory analyses did not detect the presence of hydrocarbons.
- Groundwater analyses show some elevated concentrations of the following List II substances (Groundwater Regulations 1998) with respect to DWS: Boron, Iron, Manganese, Selenium, and Sulphate.

The Hydrogeological Map (IGS, 1970) shows the Chalk in this area to have a chloride concentration of between 100 and 1000 mg/l, and becoming increasingly saline to the northeast. The Chalk beneath the Medway estuary is shown to have a chloride concentration in excess of 500 mg/l.

Water quality in Damhead Creek is likely to be brackish, and this may influence local groundwater quality.

Conclusions

Land contamination is not thought to be a significant issue for the proposed development. The proposed development site has no known previous industrial usage. Laboratory analysis of soil samples from previous site investigations has not revealed the presence of any significant ground contamination. The site is underlain by predominantly low-permeability Made Ground and alluvial clay deposits. Therefore shallow groundwater is of limited or no resource value and migration of contaminants to or from adjacent sites is considered highly unlikely.

4 Health and Safety

E.ON UK is committed to ensuring the health and safety of all its employees, and other people who may be affected by its activities. This commitment arises from many Acts of Parliament, including:

- The Health and Safety at Work Act 1974 and associated regulations
- The Factories Act 1961
- The Electricity at Work Regulations 1989
- The Electricity Supply Regulations 1988
- The Workplace (Health, Safety and Welfare) Regulations 1992
- The Construction (Design and Management) Regulations 1994 as amended by the Construction (Design and Management) (Amendment) Regulations 2000

Under the Construction (Design and Management) (CDM) Regulations, management plans will be developed for all contractual phases of the proposed Kingsnorth units 5 & 6 project including the design, construction and commissioning of the plant. A Planning Co-ordinator will be appointed during the specification of the plant for the period up to the placement of the design and construction contracts, and the Principal Contractor's role will be undertaken by one of the appointed contractors.

The contractors will be required to design the plant to incorporate health and safety features to ensure that E.ON UK's commitments are met. Procedures produced by the contractors will interface with Kingsnorth power station's site systems and safety rules. The Health and Safety Executive (HSE) will be kept informed of developments and consulted as appropriate.

Other regulations to be adhered to include, but are not limited to, the following:

- The Control of Industrial Major Accident Hazards (CIMAH) Regulations
- The Control of Substances Hazardous to Health (COSHH) Regulations
- Fire Precautions Act 1971

5 Glossary

Anthropogenic: man made or caused by human activity

CW: cooling water used in the power station

dB (decibel): Used here to represent the sound pressure level, P, expressed as twenty times the logarithm of the ratio of this pressure to a reference pressure, P_0, $2.0*10^{-5}$ N/m^2. Thus $dB = 20*Log_{10}(P/P_0)$

dB(A): As above except that the measured sound is first subject to a frequency weighting, known as the 'A' weighting, which is designed to compensate for the varying sensitivity of the human ear to sounds of different frequency

$L_{A90,T}$ The A-weighted sound level exceeded for 90% of the measurement period of duration T.

$L_{A10,T}$ The A-weighted sound level exceeded for 10% of the measurement period of duration T.

$L_{Aeq,T}$ The equivalent steady dB(A) sound level containing the same acoustic energy as the actual, measured, fluctuating level.

m^2 : square metre

m^3 : cubic metre

mgl^{-1} : milligramme per litre

ms^{-1} : velocity in metres per second

m^3s^{-1} : cubic metres per second

μgm^{-3} : micro grammes per cubic metre

Percentile: A value in the range of a set of data which separates the data which separates the range into two groups so that a given percentage lies below this value

Plume: Trail of hot gases from the chimney or warm water from discharge point

ppm: parts per million

PWL: The sound power level (PWL) is defined as the acoustic power relative to a sound power of 10^{-12} watts and is given by the expression: PWL = 10 x $\log_{10}$ (Acoustic power in watts x 10^{12})

Ruderal: Plants associated with human dwellings and waste ground.

Turbidity: being turbid, stirred up, muddiness

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