Tees Renewable Energy Plant

ENVIRONMENTAL STATEMENT

Volume 1

Prepared by

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LIST OF ABBREVIATIONS

$	United States of America dollar
μg/m^3	micrograms per cubic metre
μS/cm	microSiemens per centimetre
<	less than
>	more than
£	Pound Sterling
°	degree
°C	degree Celsius
ACC	air cooled condenser
ADMS	Atmospheric Dispersion Modelling System
AERMOD	American Meteorology Society/Environmental Protection Agency
AGLV	Areas of Great Landscape Value
AHLV	Area of High Landscape Value
ALC	Agricultural Land Classification
AOD	above ordnance datum
AONB	Area of Outstanding National Beauty
APIS	Air Pollution Information System
AQMA	air quality management area
AQS	Air Quality Strategy
BAP	Biodiversity Action Plan
BAT	Best Available Technique
BERR	Business, Enterprise and Regulatory Reform (formerly DTI)
bgl	below ground level
BS	British Standard
CaO	calcium oxide
CDM	ConDaM (Regulations) Construction, Design and Management Regulations
CEMP	Construction Environmental Management Plan
CFB	circulating fluidized bed
CHP	combined heat and power
CIRIA	Construction Industry Research and Information Association
CO	carbon monoxide
CO_2	carbon dioxide
COMAH	Control of Major Accident Hazards
COSHH	Control of Substances Hazardous to Health
dB	decibel
dB(A)	decibel (audio)
DCS	distributed control system
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of Environment Transport and the Regions
DFO	distillate fuel oil
DTI	Department of Trade and Industry
EA	Environment Agency
EAL	Environment Assessment Level
EC	European Commission

EIA	Environmental Impact Assessment
EMMP	Ecological Monitoring and Management Plan
EPR	Environmental Permit
ES	Environmental Statement
ETS	Emissions Trading Scheme
EU	European Union
BGS	British Geological Survey
GIS	gas insulated switchgear
GQA	General Quality Assessment
GW	Gigawatt
ha	hectare
HER	Historic Environment Record
HRSG	heat recovery steam generator
HSE	Health and Safety Executive
HU	(high) leaching potential
IEMA	Institute of Environmental Management and Assessment
IFA	Institute of Field Archaeologists
IGCC	integrated gasification combined cycle
IPPC	Integrated Pollution Prevention and Control
ISO	International Standards Organization
kJ/kg	kilojoule per kilogram
km	kilometre
km^2	kilometre squared
kV	kilovolt
kW	kilowatt
l	litre
l/sec	litre per second
L_A	sound pressure level
LCI	Landscapes of County Importance
LCPD	Large Combustion Plant Directive
LCV	lower calorific value
LDF	Local Development Framework
LHV	lower heating value
LVIA	Landscape Visual Impact Assessment
m	metre
M&RR	Middlesbrough and Redcar Railway
m/s	metre per second
m^3	metres cubed
m^3/h	cubic metres per hour
m^3/sec	cubic meter per second
MAGIC	Multi-Agency Geographic Information for the Countryside
mg/kg	milligram per kilogram
mg/l	milligram per litre
mg/m^3	milligram per cubic metre
mg/Nm^3	milligram per normal cubic metre
MW	megawatt
MWe	megawatt electrical

NAP	National Allocation Plan
NAQS	National Air Quality Standard
NBN	National Biodiversity Network
NMR	National Monuments Register
NNR	National Nature Reserve
NO	nitric oxide
NO_2	Nitrogen Dioxide
NO_x	oxides of nitrogen
NSR	noise sensitive receptors
OD	Ordnance Datum
OS	Ordnance Survey
PAH	poly-aromatic hydrocarbon
PCB	polychlorinated biphenyls
PF	pulverized fuel
pH	hydrogen ion concentration
PM_{10}	Particulate matter of up to 10 micron in size
ppb	parts per billion
PPC	Pollution Prevention and Control
PPE	personal protection equipment
PPG	planning policy guidance
ppm	parts per million
PPS	Planning Policy Statement
RAMSAR	An intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources
RCBC	Redcar and Cleveland Borough Council
RSPB	Royal Society for the Protection of Birds
S&DR	Stockton and Darlington Railway
SAC	Special Area of Conservation
SCADA	supervisory control and data acquisition
SI	Systéme International d' unités
SNCR	selective non-catalytic reduction
SO_2	sulphur dioxide
SPA	Special Protection Area
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Urban Drainage System
SVOC	semi-volatile organic compounds
t/day	tonne per day
TNC	Tees Navigation Company
UK	United Kingdom
US	United States
USA	United States of America
VER	valued ecological receptors
VOC	volatile organic compound
WHO	World Health Organization
ZVI	zone of visual influence

1. EXECUTIVE SUMMARY

1.1 Background

MGT Teesside proposes to construct and operate a new 300 MW biomass fired renewable energy power station (Tees REP) on land adjacent to the main southern dock at Teesport on the south bank of the River Tees in the Borough of Redcar and Cleveland. The plant will be fuelled by sustainable forestry operations, where the forests are continuously replenished as they are used.

There are 3 drivers for the construction of a new 300 MWe renewable energy power station at Teesport:

- Climate Change
- Planned closure of about a third of the UK's power station capacity by 2018
- The need to diversify away from oil and gas

Climate Change

In recent years, there has been a growing awareness of the need to reduce carbon emissions to slow down the pace of climate change resulting from human activity. The electricity generating industry is one of the major sectors responsible for carbon emissions, and hence climate change and global warming, because generation of electricity has traditionally relied upon burning of fossil fuels. **The proposed Tees Renewable Energy Plant (Tees REP) will be one of the largest biomass power stations anywhere in the world** producing carbon neutral, sustainable electricity, **saving almost 60 million tonnes of CO_2 over its lifetime** and contributing **over 3% of the UK's mandatory Kyoto emissions reductions**

Electricity Generation

Between now and the year 2018, about a third of the UK's electricity generation capacity is set to retire as nuclear stations reach the end of their safe operating lives, and improved environmental standards force ageing coal and oil stations to close. It is essential to Britain's economic health that this generation capacity is replaced in a manner that is clean, secure and economically efficient. The planning and construction of new power stations can take at least 5 years (and considerably longer for nuclear power stations), and therefore it is essential that the country starts planning for new power stations now. The Tees REP, if given planning permission, will be operational by 2012 and would make a significant contribution to the UK generation mix, **providing enough electricity to supply about 600,000 UK households with renewable energy.**

Security of Supply

While natural gas will continue to play a significant role in meeting Britain's energy needs, it is highly desirable that our sources of energy become more diverse in order to reduce the country's exposure to price volatility and supply interruptions as the UK's North Sea production declines and imports increase. It is currently estimated that the UK will rely on gas for over 60% of its electricity generation

by 2015, while over 80% of the UK's gas supply will be imported by 2020. Gas prices are now linked to oil prices due to dependence on European supply contracts, and with global oil prices at historic highs gas prices are trading at over 3 times the average for the decade. **The Tees REP will help the UK diversify its sources of energy, reducing our dependency on fossil fuels, which have reached historically high costs in recent months.** The UK is well placed to grow biomass feedstock, such as wood chips, that can be used in the proposed plant, thereby providing additional security of supply.

Sustainable Energy Policies

The above drivers have lead both the United Kingdom (UK) and the European Union (EU) to identify targets for the use of renewable energy. In March 2007 the EU announced its Climate Change and Energy Package. This initiative saw the EU set ambitious environmental goals to increase energy efficiency and reduce greenhouse gas emissions by at least 20 per cent by 2020 and to further promote renewable energy sources by setting a minimum EU-wide target of 20% of all energy to be derived from renewable sources. **The policy proposed that the UK adopt a binding target of 15% of <u>all energy</u> to be derived from renewables by 2020.**

The key government policy for promotion of renewable energy in the UK is the **Renewables Obligation,** which currently obliges electricity suppliers to procure an increasing amount of their sales from renewable sources, reaching 15.4% in 2015. The **'Renewable Energy Strategy'**, published in June 2008, now asks industry and public to consider the implications of increasing the Renewables Obligation to 30 to 35% of electricity sales by 2020 in order to meet the EU targets. **The proposed Tees REP will make a very significant contribution to the renewable energy targets of the North East and the UK, generating 300 MW of renewable electricity and contributing 5.5% of the UK's Renewables Obligation 2012 target.**

The **Renewable Energy Strategy** also estimates that to in order meet the UK's target's, about 80 TWh of energy from biomass will need to be produced either as electricity or heat. **Tees REP will be able to supply about 2.4 TWh or 3% of the Bio-energy target included in the Renewable Energy Strategy**.

1.2 Introduction

MGT proposes to construct and operate a new 300 MW biomass fired renewable energy power station on land adjacent to the main southern dock at Teesport on the south bank of the River Tees in the Borough of Redcar and Cleveland.

This document is the Environmental Statement (ES) which has been prepared to accompany the application to the Secretary of State at the Department of Business, Enterprise and Regulatory Reform (BERR) for consent to construct the plant under Section 36 of the Electricity Act 1989. The ES itself provides extensive details of the Environmental Impact Assessment (EIA) undertaken for the project which was undertaken in full accordance with the requirements of the electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000.

The undertaking of the full EIA followed the completion of a scoping study in May of 2008 during which both statutory and non statutory consultees to the process were consulted to help define the

scope of the investigations. The Section 36 application to emerge from this process is considered to be a robust assessment of the plants likely impact to the receiving environment.

A number of public exhibitions are planned in the area of the site to help inform members of the general public about the EIA undertaken and the details of the Section 36 application to BERR. Exact details of these meetings will be published in the local press near the time.

Copies of the ES are available for public viewing at Redcar and Cleveland Council Offices during working hours and the South Bank Library, Middlesbrough which is open on Monday, Tuesday, Wednesday and Friday 9.30 am to 7.30 pm and on Saturday from 9.30 am to 12.30 pm.

An electronic copy of the application can be requested from MGT via the website: www.mgtteesside.com from where a copy of this Non Technical Summary can also be downloaded free of charge.

Further information can be obtained directly from MGT by writing to 16 Old Queen Street, London, SW1H 9HP. Emails can be sent to info@mgtteesside.com.

1.3 The consents process

The plant will require consent under Section 36 of the Electricity Act 1989 which requires that generating stations greater than 50 MWe shall not be constructed, extended or operated without permission from the Secretary of State at BERR.

Consent under Section 36 of the Electricity Act removes the need for the plant to obtain planning permission directly from Redcar and Cleveland Council though the council remains a statutory consultee to the planning process. Should the Tees REP be awarded a Section 36 consent by BERR then this will also constitute planning permission under the Town and Country planning Act 1990.

In due course MGT will separately apply to the Environment Agency for an Environmental Permit (EPR) under the Environment Agency Environmental Permitting (England and Wales) Regulations 2007, that will define the manner in which the plant is operated on a day to day basis.

Other miscellaneous consents and permits will be sought as necessary through the course of the project development.

1.4 The Developer

The developer of the Tees REP is MGT Teesside Limited, a wholly owned subsidiary of MGT Power Ltd. MGT Power is a renewable energy company comprised of industry experts backed by major UK fund management firms with power industry experience, between them managing investments of over $6 billion. MGT Power is developing similar power projects in Europe and forestry projects to supply these facilities.

MGT's management team also has extensive experience with biomass supply and logistics and power project development.

MGT believes sustainable forestry based biomass has the potential to make a significant contribution to the UK's CO_2 and renewable generation targets.

1.5 The Tees REP site

The site is located on 14 ha of land within the Teesport landholding approximately 5 km east of Middlesbrough and 6 km west of Redcar. Immediately adjacent to the site is Teesport which makes the site ideal in terms of any necessary import of fuel for the proposed plant .

In addition to deep water access the site is well served by A roads and is directly connected to the A66 which is a primary road for access to the site and which leads to the A1. The site is also served by a rail connection to the wider National Rail network.

The site is also in close proximity to the National Grid electricity transmission system and MGT Teesside has a transmission contract to export power from the site from 2012.

Historically the site was occupied by an undeveloped intertidal foreshore of open sands, associated with the banks of the River Tees that was reclaimed by 1950 through to 1965 with the site housing a number of storage tanks and associated buildings. The site was at one time bisected by the Kinkerdale Beck which was culverted in 1994. The tanks associated with the oil refining operations on site were demolished at the same time with the exception of six tanks still present in the south eastern corner of the site.

The site is currently unused and available for development as a renewable energy generating plant. The location of the site can be seen in Figure 1.1

1.6 Project summary

The project will comprise a single circulating fluidised bed boiler that will burn wood chip to generate steam at 565C. The steam will be used to turn a steam turbine that will in turn rotate a generator to produce electricity.

After all of the useful work has been extracted from the boiler steam (cooling it to approximately 30C), the steam will be condensed in an air cooled condenser, greatly reducing the need for water, avoiding any water abstraction from the River Tees, and minimising the amount of effluent emitted from the site

Emissions to air will be released through a 95 m stack. Air emissions will be minimised through the appropriate selection of clean wood chip, together with the use of state of the art emission reduction technologies including Selective Non catalytic Reduction to minimise emission of nitrogen dioxide and fabric filters to reduce emission of dust and sulphur dioxide.

If consented the proposed plant could be operational by 2012. The plant would have an operational lifetime of at least 25 years and would directly employ some 150 members of staff throughout this period. The Tees REP development would represent an investment of over £400 million and will spend circa £30 million per year of operation in ongoing costs.

The project will be one of the largest of its kind in the world and when constructed will contribute 5.5 per cent of the UK's 2012 Renewables Obligation target and over 3 per cent of the UK's CO_2 reduction targets.

MGT Teesside is liasing with local industry and developers in order to accommodate a combined heat and power (CHP) element to the proposed plant should a suitable off taker be identified. CHP will help make the plant more efficient and help to further reduce the generation of greenhouse gases in the surrounding area by displacing boiler plant that neighbouring sites may currently be operating to generate steam for their own processes.

1.7 The construction phase

Initial construction works will comprise of site clearance, removal or remediation of any existing contamination present within the site.

In parallel with the site clearance, a temporary construction compound will be located within the fuel storage area. This laydown area will be used to house temporary construction site offices, material and equipment storage, fuel storage and car parking, and may also be used for component fabrication works.

Excavations will be required to construct foundations, culverts, buried services and basement structures. In addition it will be necessary to undertake piling for the foundations where the heavier plant equipment will be located.

Once the foundations are in place the remainder of the plant including all buildings and above surface infrastructure will be constructed. Some of this will be fabricated on site though more intricate items such as the steam turbines will be manufactured and assembled prior to arrival on site.

Where practicable, wastes generated during construction will be recycled. All construction surplus and waste materials will be stored in dedicated areas and will be regularly removed to a licensed waste management site by an appropriately licensed waste carrier.

Construction of the new plant is expected to commence in 2009 and last for some 32 months. The construction workforce will peak at about 600 with of the order of 60 per cent of these expected to be from the surrounding area. The target date for full operation is summer 2012.

1.8 The plant

There are a number of key items of that make up the proposed renewable energy plant. A description of these plant items is included below.

1.8.1 Boiler

The plant will be equipped with a single circulating fluidized bed boiler. The fluidized bed within which the wood chip fuel will be combusted will comprise sand, fluidized by the injection of combustion air at the base of the bed. The hot combustion gases will carry the solid matter through the combustion chamber and into heavy duty cyclones where the solids will be separated from the hot combustion

gas and recirculated back to the bottom of the main combustion chamber. The hot combustion gas will then flow vertically down through the boiler, raising steam which is subsequently passed to a 300 MW steam turbine.

1.8.2 Steam turbine

Steam generated by the boiler is at very high pressure (174 times atmospheric pressure) and is allowed to expand through a steam turbine turning a series of blades as it does so. These blades are connected to a shaft which in turn is connected to the plants generator. At full output the blades turn at some 3000 revolutions per minute. By the time the steam exits the steam turbine it has lost most of its heat and is condensed and returned to the boiler to repeat the cycle.

1.8.3 Air cooled condenser

Air cooled condensers, which work much like a car radiator, will be used to cool and condense the steam exiting the steam turbine for re-use in the boiler. The use of air cooled condensers means that there is no need for cooling towers or a once-through cooling water system, thereby eliminating the environmental impacts associated with such systems, which include a visible plume from a cooling tower and abstraction from, or discharge to, a local water course.

1.8.4 Generator

The shaft that runs through the centre of the steam turbine also passes through the plants generator where it rotates in the presence of a large magnetic field which in turn allows the generation of a large electric field producing electricity (similar to a dynamo). The electricity is transferred from here to the generator transformer where the voltage is stepped up to 400,000volts prior to the electricity being exported to the National Grid network.

1.8.5 Selective non catalytic reduction

Selective non-catalytic reduction (SNCR) is the reaction of a reagent, commonly urea or ammonia, with the NO_X in the flue gas leaving the boiler, to form molecular nitrogen (N_2) and water (H_2O).. The proposed plant will include such a process as part of the overall plant design to minimise emissions of NO_x.

1.8.6 Fabric filters

Prior to entering the stack the spent gases from the boiler will pass through fabric filters that are effectively large bags designed to capture the majority of dust/ash that may have escaped the boiler. These filters also help to capture any traces of sulphur dioxide or other acidic gases which are absorbed by the alkaline ash.

1.8.7 Stack

After passing through the fabric filters the flue gas will be released to the atmosphere via a dedicated 95 m stack. The height of the stack has been determined through a computer modelling exercise to ensure that the height is sufficient to allow for proper dispersion of the flue gases from the plant.

1.8.8 Fuel storage area

The REP will be fuelled by around 2 400 000 tonnes of clean wood-chip fuel per year with up to 120 000 tonne stored on the plant's enclosed on-site store area to be located to east of the REP. A mobile fuel discharger/reclaimer will disperse the fuel into stockpiles of up to 15 m high with the fuel regularly rotated to allow the release of moisture and heat, preventing self heating. Fuel will be transported from here by conveyor to the boiler of the REP.

1.9 The Environmental Impact Assessment

The project has been the subject of a full Environmental Impact Assessment in full accordance with the requirements of the electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000. The below summarizes the findings of these investigations.

1.9.1 Air quality

Air quality in the Teesside areas is generally good with neither Redcar and Cleveland Borough Council nor any of the districts which are in close proximity to the site having identified any significant air quality issues.

During construction of the plant dust may be generated from day to day activities. Dust generation will be minimised by careful onsite construction management and control, and will include wheel washing facilities, water spray dampening of soil stockpiles, and use of mobile road sweepers to control dust accumulation. It is highly unlikely however that dust generated at the site will cause nuisance at houses in the area with the nearest property being almost 2.5 km from the site.

During operation the proposed plant will fire on woodchip supplied from certified sustainable forestry operations. The combustion of this renewable fuel will not produce any net increase in CO_2 (a green house gas) but will generate other gases with the potential to impact on the environment including oxides of nitrogen, sulphur dioxide and particulate matter (dust) as well as traces gases such as hydrochloric acid. Clean woodchip fuel is naturally low in sulphur, ash and other elements when compared to coal or recycled wood, and combustion in a circulating fluidised bed boiler naturally produces less NO_X. Using a cleaner fuel and process than a comparable thermal plant running on coal or recycled wood means that the potential for emissions are greatly reduced.

Nevertheless to minimise further the release of these gases the plant will be fitted with SNCR and fabric filters that will reduce emissions of NO_x, SO_2 and PM_{10}'s. The use of a circulating fluidised bed boiler also helps to reduce emission by maximising efficiency and ensuring good combustion, which minimises release of particulate matter and carbon monoxide (both products of poor combustion).

To ensure that any gases which are emitted are dispersed in a manner that will not give rise to significant impacts on ambient air quality an air dispersion computer modelling exercise has been undertaken for the project. This exercise modelled various stack heights under worst case conditions. It showed that a 95m high stack will ensure that all ground level concentrations for the gases emitted are well below the levels identified by the Environment Agency as being desirable to protect human health and results in an insignificant local impact when considered in isolation and in conjunction with the existing background and other proposed developments in the surrounding area.

The peak concentration long term emissions of nitrogen dioxide and sulphur dioxide are predicted to be well within the relevant guidelines and in any case occur in industrial areas with no residences nearby.

The air dispersion exercise also considered the impact on sites protected for their ecology finding that in no case would the REP significantly affect these sites which in the majority are well removed from the site.

Dust nuisance from the unloading and handling of the wood chip fuel will be avoided by using enclosed conveyors and storage buildings.

1.9.2 Water quality

During the construction phase the discharge of any effluents, including site drainage, will be agreed with the Environment Agency and Northumbria Water, including detailed methods of treatment and disposal. Industry standard good working practices will ensure that any impacts due to the water discharging from the site would be insignificant.

Water for the duration of the construction period, as for the entirety of the operational phased will likely be taken from the existing mains water supply in the Teesport site.

The construction of the plant will involve the uncovering and subsequent re-direction of the culverted Kinkerdale Beck which runs directly beneath the REP site. There are two options for the re-routing of the beck and these will be discussed with the relevant authorities prior to the commencement of any construction works to determine the most appropriate route. The two options include the routing of the beck east to the Teesport Dock or diverting it around the main items of plant before discharging to the existing release point to the north of the site. Care will be taken to ensure that the beck is not contaminated with made ground and that the water quality of the beck is not affected by re-directing.

During normal operation water from the mains supply only will be required on a day-to-day basis for make-up to the boiler water system and small domestic uses like operator toilet facilities.

The Tees REP will use air cooled condensers rather than a wet cooling tower or direct (river) cooling. This decision means that one of the major uses of water, and sources of effluent, has been avoided and no water will be abstracted from the River Tees.

On a day-to-day basis, the only process effluent produced by the proposed plant will comprise the blowdown from the boiler and the demin plant effluent. In addition there will be domestic effluents from the wash rooms across the site.

Small quantities of purified boiler water (boiler blowdown) are discharged in order to avoid the build-up of impurities in the boiler water. This discharge is virtually pure water, containing very small quantities of various chemicals that are used to prevent corrosion and scaling in the boiler. The boiler blowdown will be recovered and reused in the demineralization plant as much as achievable. The remainder will all be discharged to the existing sewerage system on the site.

The quality of the effluent to be discharged from the plant will be monitored for flow, pH, suspended solids and oils and grease. These discharges will be controlled to limits set by the Environment Agency in the plant's EPA Permit.

Any areas of the site that are likely to be contaminated with oil or suspended solids, including wood chip dust, will drain to oil interceptor(s) and solids filtration to limit visible oil in the water and to remove suspended solids. This filtered surface water, together with waters from non-contaminated areas, will drain to the River Tees.

1.9.3 Noise

Noise generated by the plant should not prove to be a significant issue at local residences due to the nearest house being some 2.5 km from the proposed REP site.

A detailed noise impact assessment has nevertheless been undertaken for the project to demonstrate that the impact of the project will be insignificant.

The assessment undertaken was completed in accordance with procedures outlined in BS 4142:1997 "Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas" to ensure a robust approach.

The assessment included the assessment of likely noise levels at that would be generated by the plant during the construction and operational phases of the project. The results of this exercise were compared with the existing baseline that was recorded at locations which were agreed with the Environmental health Officer at Redcar and Cleveland Council.

The modelling undertaken proved that the plant would not be detectable within the existing noise baseline at properties in the surrounding area. The noise from the plant will only be detectable in the industrial areas that surround the plant.

The results of the modelling were also used to inform the ecological investigations for the project which identified that there would be no significant impact at local ecologically designated sites with regard to noise produced during the projects various phases.

1.9.4 Visual impact

A landscape and visual impact assessment has been undertaken for the project including the preparation of photomontages from which an impression can be ascertained as to the likely scale and visual impact of the plant.

The substantial buildings envisaged on site are the turbine hall, boiler plant, air cooled condenser, wood storage area and storage tanks. The remaining plant and equipment will, in the main, be housed in relatively low buildings, of the order of 3 to 6 m in height. The tallest structures on site will be the 95 m high stack and the 55 m high boiler.

The change to the existing landscape is not predicted to be significant given the industrial setting of the site which already dominates the wider Teesside industrial area with the plant being difficult to see from the majority of the surrounding area.

Due to the nature of the clean wood chip fuel which has a high water content there will, under some weather conditions, be a visible plume from the stack that will be visible over a wider area. The plume will be clean/white in appearance with computer modelling suggesting that the length will not exceed 550 m with a length of 110 m being mode typical when the plume is visible at all. For the majority of the year, about 80 per cent of the time, there would be no visible plume at all. The use of air cooled condensers means that cooling towers, a significant source of visible plumes in the area, will not be used.

1.9.5 Traffic and infrastructure

The 32 month construction period for the proposed Tees REP will give rise to additional transport movement on the local transport network. For this reason a green travel plan will be agreed with the local highways officer prior to the commencement of the construction phase to help mitigate the potential impact of the proposed works to local and regional traffic and infrastructure. Workers will be encourages to car pool or use minibuses that would be provided by the construction contractor. Traffic will also be co-ordinated with PD Teesport, to further mitigate any local impacts.

MGT Teesside will require that all vehicle movements relating to the proposed development travel along the A1053 Tees Dock Road to ensure that there is little to no impact on local residents.

In addition to traffic movements associated with the 600 construction staff, construction traffic will consist of civil works traffic, mechanical works traffic and a small number of abnormal loads for components such as the steam turbines. Approximately 45 heavy commercial vehicles per day will be expected on average. Deliveries will be spread throughout the day, at a maximum rate of around 5 per hour and will avoid peak traffic hours

The number of abnormal loads is likely to be of the order of 5 over the 32 month construction period. The transport of abnormal loads, which may lead to delays and cause inconvenience to other road users, would be timed following consultation with the relevant authorities to minimize disruption to the other road users.

Operation of the proposed plant will naturally result in much fewer traffic movements than those associated with construction. The delivery of the biomass fuel to site will be by sea to the deep water quay that serves the site and will have no effect on the local infrastructure. Ash produced by the process will be removed from site by approximately one covered truck per hour.

MGT anticipates that locally farmed energy crop biomass may be brought to site by road. This would be delivered in 30 tonne HGVs.. Where possible the HGV trucks used to deliver the biomass would also be used to transport the ash produced by the plant, thereby reducing incremental traffic impact by up to 33 per cent. These vehicle movements would be strictly kept to off peak hours and in any case will not exceed a number deemed acceptable by the relevant authorities.

1.9.6 Socio-economics

At its peak, the construction workforce would total about 600. Most of the workforce will be recruited locally. Approximately 150 staff will be required for roles and tasks associated with the daily operational and maintenance requirements of the new plant. MGT will start the recruitment of permanent staff early in the construction phase and, in partnership with the relevant local authorities and training agencies, will look to provide appropriate local training and skills programmes for applicants.

Total investment in the project will be of the order of over £400 million with the operational and maintenance costs of the proposed plant being in the region of £30 million per annum. In addition to the use of local services, a significant proportion of this will serve to benefit the local economy in terms of employee wages, local purchases and local capital expenditure. It is expected that annual expenditure of this level could create an additional 300-500 jobs, indirectly, in the local economy. Dock dues worth £7 million per year will also constitute an additional revue stream for the local economy.

Locally MGT will strongly encourage the contractor who will construct the project to use locally sourced materials and locally based contractors as part of their proposals so as to maximize the benefit to the local economy. Local companies that have already expressed interest in involvement in the construction and operational phases include AMEC (Darlington), Foster Wheeler (Middlesbrough), Kvaerner (Stockton on Tees) and PX Power (Middlesbrough).

It is MGT's hope that a market will emerge for locally farmed energy crop biomass as a result of the construction of the plant. MGT anticipates that locally farmed energy crop biomass may ultimately provide of the order of 200,000 tonnes per annum. The cost of the biomass can be expected to be £80 per ton (at current market rates), therefore sourcing the biomass fuel locally could lead to an addtional positive contribution in the region's economy of over £16 million. MGT will actively seek locally farmed energy crop wherever practical and will look to hold discussions with local farmers to discuss this possibility.

1.9.7 Ecology

An ecological impact assessment of the proposed Tees REP development site has been undertaken comprising a detailed desk study, consultation and field survey, including full reptile surveys.

The REP site comprises mostly of hard standing and buildings interspersed with semi-improved grassland and areas of occasional scrub and ruderal vegetation with little to no ecological value. The Kinkerdale Beck which is of little ecological value passes directly beneath the site before draining to the River Tees.

The site is not itself the subject of any ecological designation with the nearest designation being a Site of Special Scientific Interest which also forms part of the Teesmouth and Cleveland Coast Special Protection Area, approximately 1.5 km to the south west. Neither the designated sites nor their associated species were considered to be at any risk of significant impacts as a result of the proposed development.

Bran Sands and Vopak Foreshore, both habitats of local importance are located within approximately 1.5 km and 0.75 km (respectively) of the REP site and are used by protected and notable bird species. No significant direct impacts on these sites or associated species are expected as part of the construction and operational phases.

Post-development mitigation will provide net ecological gain in line with the requirements of Planning Policy Statement (PPS) 9. The opportunities for post-development landscaping on site are limited by available habitat and as such off-site compensation in the local area will be implemented and is considered to provide sufficient mitigation for the effects of the scheme. MGT will partner with other local industry and INCA in the area to re-establish intertidal habitat for a variety of species, including invertebrates and birds.

An Environmental Management Plan (EMP) will be produced and implemented for the site prior to any construction works and will include provisions to protect and enhance the wildlife habitat in the vicinity of the site, including the prevention of pollution incidences with potential to impact upon the culverted stream and the Tees.

1.9.8 Land use and contamination

The nature of the soils beneath the REP site are well understood from physical investigations at the site including boreholes and trial pits.

The main potential sources of contamination at the site are the backfill (made ground) used to re-claim the site from the River Tees and the previous use of the site as an oil storage depot. Potential sources of contamination also include the steel export terminal in the north-eastern area of the site and the (now disused) electricity substation in the centre of the site. Potential off-site sources of contamination include the adjacent SABIC chemical storage tanks.

Despite the potential issues associated with the above the physical investigation of the site has not shown the site to suffer from any significant levels of contamination. Due to the relatively small amounts of contamination at the site and the presence of the attenuating alluvial deposits underlying the made ground, it is not anticipated that significant concentrations of contaminant could leach to surface water or groundwater. Nevertheless care will be taken to ensure that any soils excavated from the site are not allowed to impact on surface water in the vicinity of the site. Any standing water that forms on site will be dealt with in a manner to be agreed between the contractor and the Environment Agency.

During operation all areas of the site will drain to appropriate drainage systems on site thereby mitigating the potential for contamination of ground or surface waters. Disposal of all waste materials, whether hazardous or not, will only be via appropriate and authorized routes.

1.9.9 Cultural heritage

As part of the Environmental Impact Assessment a full archaeological desk based assessment (DBA) has been undertaken for the proposed site, as well as a site visit.

The assessment established that no statutorily protected archaeological or heritage site will be directly affected by the Project. In addition there are no listed buildings within the wider study area, so the development will have no impact on any such buildings or their settings.

When the archaeology of the site itself was considered it was identified that there was some potential for survival of palaeo-environmental and archaeological remains beneath the site. It was considered however that the remains would mostly be from the modern era and of negligible importance. This was due to the nature of the ground beneath the site which mostly comprises made ground reclaimed from the River Tees.

The DBA recommended that archaeological evaluation by trial trenching not be carried out within areas of proposed development impact. However, MGT Teesside will make available the results of geotechnical site investigations to an archaeological consultant or the archaeological development control section at Tees Archaeology and help devise a mitigation strategy for the REP development.

1.9.10 Environmental management

Detailed mitigation and monitoring measures have been identified as part of the Environmental impact assessment that will be fully incorporated into the plats detailed design.

During the construction phase of the project MGT will require the contractor to prepare and implement a Construction Environmental Management Plan (CEMP). This Plan will identify the mitigating measures and management procedures that will be put in place to adequately control the environmental impacts of the construction stage, incorporating the relevant sections in this document and the application for a EPA Permit. A waste management plan will also be developed.

During the operational phase of the project the plant will operate in full compliance with the requirements of the plants EPR permit from the Environment Agency. In addition the plant will work towards accreditation of the plants Environmental management System (EMS) under the ISO14001 accreditation scheme (or similar).

2. INTRODUCTION

2.1 The Project

MGT Teesside Limited, hereafter referred to as MGT, proposes to construct and operate a new biomass power station at Teesport. The plant, to be known as the Tees Renewable Energy Plant (Tees REP) will be located on land adjacent to the main southern dock at Teesport on the south bank of the Tees.

The proposed plant will provide a nominal 300 MW of power generation capacity at rated site conditions. The plant will fire clean wood chip sourced from sustainable forestry operations, though during start up fuel oil (likely biodiesel) will be burnt to allow the boilers to achieve the necessary heat to ensure combustion of the wood chip. There is some potential for the plant to supply low grade heat to suitable heat off takers in the vicinity of the site subject to technical and commercial considerations.

This Environmental Statement (ES) has been prepared in support of an application for Section 36 Consent under the Electricity Act 1989 to the Department for Business, Enterprise and Regulatory Reform (BERR) (formerly the DTI) to construct and operate an electricity generating station greater than 50 MWe output. The ES has been prepared by PB Power on behalf of MGT and details the results of a comprehensive study of the environmental impacts of the proposed biomass power station, its location and the mitigation measures designed to minimize the environmental effects of the proposed development.

Section 90 of the Town and Country Planning Act 1990 provides that on granting a consent under Section 36 of the Electricity Act 1989, the Secretary of State may direct that planning permission for the development shall be deemed to be granted. It is not therefore necessary to apply for a separate planning permission for the Teesport plant. However the relevant planning authority, in this case Redcar and Cleveland Borough Council (RCBC), is a statutory consultee in the consenting process and has been consulted in the preparation of this document together with another seven statutory consultees (as well as many non-statutory consultees) as listed in Section 2.3.1. Draft consent conditions for the construction and operation of the proposed plant have been proposed, full details of which can be found in Appendix A.

Figure 1.1 shows the location of the site, to the west of the main dock at Teesport. The site is located on 14 ha of land within the Teesport landholding approximately 5 km east of Middlesbrough and 6 km west of Redcar. The site falls within the jurisdiction of Redcar and Cleveland Borough Council in Tees Valley.

On the eastern side of the site there is an existing steel framed warehouse and Tees Dock quay. The steel framed warehouse building is under utilized, and will be dismantled prior to the commencement of any works. Cleveland Potash operates on the opposite side of Tees Dock (the eastern side) where they handle and store dry bulk products.

To the west of the proposed site is a tank farm owned by Sabic (previously Huntsman Chemical) which is used for the storage of various chemicals such as Benzene, Xylene, Paraxylene and Butadiene. There are a series of pipelines associated with the tank farm that run around the perimeter of the site.

The Site is well served by A roads and is directly connected to the A66 which is a primary road for access to the site and which leads to the A1. The Teesdale Way, a long distance footpath, runs to the north of the A1085, between various heavy industrial developments.

Historically the site was undeveloped intertidal foreshore of open sands, associated with the banks of the River Tees that were reclaimed by 1950 through to 1965 with the site eventually housing a number of storage tanks and associated buildings. The site was at one time bisected by the Kinkerdale Beck which was culverted in the 1994. The tanks were associated with a nearby oil refinery, and were demolished at the same time as the refinery, with the exception of six tanks still present in the south eastern corner of the site.

The terrain surrounding the site is typical of that found in surrounding area, being flat and of an elevation of the order of 5 m AOD. The area is dominated visually by the surrounding industry.

The proposed renewable energy plant will use circulating fluidized bed (CFB) boiler technology. The fluidized bed within which the fuel will be combusted will comprise sand, fluidized by the injection of combustion air at the base of the bed. The hot combustion gases will carry the solid matter through the combustion chamber and into heavy duty cyclones where the solids will be separated from the hot combustion gas and recirculated back to the bottom of the main combustion chamber. The hot combustion gas will then flow vertically down through the boiler, raising steam which is subsequently passed to a 300 MW steam turbine.

The combustion temperature of the order of 900°C and residence time of about 20 seconds will both be high enough to ensure high efficiency combustion and therefore low carbon monoxide formation, whilst limiting formation of nitrogen oxides.

The hot gases in the boiler generate steam at a high-pressure which drives the steam turbine plant to generate electricity. The approximate efficiency based on the LHV of the fuel will be of the order of 37 per cent. This efficiency rating does not take into account the potential for added efficiency if it proves technically and economically feasible to provide heat to surrounding facilities and operate in combined heat and power (CHP) mode.

The export of electricity from the power station will be via a 400 kV substation and new dedicated 400 kV underground cable to the transmission line that runs immediately to the south of the site. Alternatively an underground cable may run from the site south to a nearby, existing National Grid substation.

The boiler will be equipped with selective non-catalytic NO_X reduction technology (SNCR), the proven pollution control technology to limit the emission of oxides of nitrogen (NO_x) to a maximum of 150 mg/Nm^3, well within the required legislation. To ensure that the plant is able to meet this limit the combustion environment will be very turbulent, which avoids the formation of hot or cold spots. SNCR technology will be used to reduce the NO_x emissions further still. These techniques represent the Best Available Technique (BAT) for limiting emissions of NO_x to atmosphere from CFB boilers of the size proposed. The emissions of NO_x will therefore be in accordance with the limits set in the Large Combustion Plant Directive (LCPD).

In addition to the heavy duty cyclones noted above, a separate fabric (bag) filter will be used to reduce the final particulate (dust) levels in the exhaust stack to 20 mg/Nm^3. The low levels of sulphur in the fuel, coupled with the highly alkaline nature of wood ash, means that the wood ash acts as a natural "scrubbing" media in the fabric filter. Nevertheless, the fabric filter is also capable of injecting calcium oxide (CaO) into the combustion gases to further reduce halides and sulphur concentration should this prove to be required during commissioning, though this is considered to be highly unlikely.

The flue gases from the plant will be discharged to 95 m stacks. The flue gas exit temperature of 95°C and velocities above 25 m/s will be maintained to ensure optimal dispersion.

Total investment in the project will be of the order of over £400 million. In addition, operational and maintenance costs will be of the order of £30 million per annum, a significant proportion of which will benefit the local economy.

It is MGT's hope that a market will emerge for locally farmed energy crop biomass as a result of the construction of the plant. MGT anticipates that locally farmed energy crop biomass may ultimately provide of the order of 200,000 tonnes per annum, depending on interest from local farmers and other land owners, while the Tees REP has the option of using rail delivery to reduce traffic impacts should regional supply exceed 200,000 tonnes per annum. This approach will make a positive contribution to the local economy and MGT will actively seek sourcing from local sources wherever practical.

Construction of the new plant is expected to commence in the middle of 2009. The construction workforce will peak at about 600 with of the order of 60 per cent of these expected to be from the surrounding area. The target date for full operation is summer 2012. Operational staff for the new plant will be of the order of 150 personnel, and there will be another 300-500 offsite jobs created as an indirect consequence of the project. During outages for maintenance up to 200 temporary staff may visit the site for a period of about a month. Planned major outages for inspection and repair will occur about once every three or four years, depending on the requirements of the insurance market.

It is expected that for the majority of its life the plant will operate at base load, except for essential maintenance and statutory inspections. It will be designed and constructed with an average annual availability design target of at least 93 per cent. The plant will be designed to have an expected operational life of at least 25 years.

2.2 The Developer

The developer of the Teesport plant is MGT Teesside Limited, a 100 per cent subsidiary of MGT Power Ltd. MGT Power is a renewable energy company comprised of industry experts backed by major UK fund management firms with power industry experience, between them managing investments of over $6 billion.

MGT's management team also has extensive experience with biomass supply and logistics and power project development.

MGT believes sustainable forestry based biomass has the potential to make a significant contribution to the UK's CO_2 and renewable generation targets.

2.3 Environmental Impact Assessment

The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 SI 2000 No 1927 require that any application for consent for a thermal power generating plant of 300 MW thermal input or greater must be accompanied by an Environmental Statement.

This ES comprises a comprehensive study of the baseline environmental conditions of the proposed power station location, the predicted impact of the plant and the mitigation measures necessary to protect the environment from the impact of this new project.

A detailed scoping and consultation exercise has been undertaken to identify the potential environmental issues associated with the construction and operation of the proposed Power Station and how these should be addressed in this Environmental Impact Assessment (EIA) (under the provisions of Part IV of the EIA Regulations). MGT sees communication with the local community and other stakeholders as a vital part of the development process so that all concerns are considered in the EIA process.

2.3.1 Scoping exercise

A Scoping Study was prepared for the project during January - April 2008. This was undertaken independently by Environmental Resource Management (ERM). This described the key environmental issues that, in MGT and their consultant's opinion, would require detailed evaluation as part of this environmental impact assessment process. The document was forwarded to BERR and to another 29 relevant local, regional and national regulatory bodies and interested stakeholders (see below) deemed to have a relevant interest in the development. The Scoping Study was then revised in the light of the comments received to form the Terms of Reference to the Environmental Impact Assessment. The organizations consulted were as follows:

- BERR, Electricity Consents Team
- Environment Agency
- English Heritage
- Tees Valley Wildlife Trust
- Highways Agency
- Inca (Industry Nature Conservation Association)
- Newcastle International Airport
- Government Office North East (GONE)
- One North East
- British Geological Survey
- North East Chamber of Commerce
- Natural England, East of England Region
- Redcar and Cleveland Borough Council
- The RSPB
- Health and Safety Executive
- National Monument Record Office
- Civil Aviation Authority
- Durham Tees Valley Airport
- Yearby Airstrip Trust
- The National Trust
- The Ramblers Association
- Lazenby Community Liaison Panel

- Dormanstown Liaison Panel
- Cleveland Emergency Planning Unit
- Redcar and Cleveland Local Partnership
- Renew Tees Valley
- Grangetown Liaison Panel
- British Telecom
- Campaign to Protect Rural England
- Network Rail

The consultation with interested parties has continued throughout the Environmental Impact Assessment of the proposed project, through meetings and exchanges of correspondence. These are detailed further in Appendix B, Statement of Community Involvement (SCI).

2.3.2 Environmental Statement

This Environmental Statement is structured as follows:

Volume 1

Section 1	-	Non Technical Summary
Section 2	-	Introduction
Section 3	-	Need for the Project
Section 4	-	Project and Site Description
Section 5	-	EIA Methodology
Section 6	-	Air Quality
Section 7	-	Water Quality
Section 8	-	Noise and Vibration
Section 9	-	Land Use and Contaminated Land
Section 10	-	Landscape and Visual
Section 11	-	Traffic and Infrastructure
Section 12	-	Socio-economics
Section 13	-	Ecology
Section 14	-	Archaeology and Cultural Heritage
Section 15	-	Summary of Mitigation and Monitoring

Volume 2

Appendices

Volume 3

Figures

For each impact considered the existing environment has been described, the potential impacts of the construction and operation phase have been discussed and mitigation measures and monitoring programmes proposed where appropriate. Where cumulative impacts are predicted these are discussed in the relevant impact section of the ES.

The worst case option has been considered to allow final design flexibility. This ensures that the ES evaluates the plant alternatives of the greatest potential impact.

2.4 Environmental Permit

The proposed plant will require a number of consents/permits additional to the Section 36 Consent. The most significant of these is Environmental Permit (EPR), issued by the EA under the Environment Agency Environmental Permitting (England and Wales) Regulations 2007.

It is a statutory requirement that certain processes, such as the proposed power station obtain a Permit from the EA before operation can begin. To obtain this Permit it must be demonstrated to the EA that discharges to air, water and land will be controlled in an integrated manner and that the plant uses the BAT principle to control pollution.

The development will be required to meet all relevant standards set by the EA, as set out in the Integrated Pollution Prevention and Control (IPPC) Sector Guidance Note for Combustion Activities V2.03 dated 27 July 2005.

The EA will control all aspects of the operation of the process including technical and procedural aspects, and will impose legally binding conditions for the plant's operation. An application for a EPR Permit will be submitted to the EA. MGT is confident that Tees REP will meet the required standards, thus ensuring compliance with the Permit.

2.5 Legislative and Planning Policy Context

The ES has considered all relevant legislation and guidance as appropriate including that of the United Kingdom (UK) and the European Community (EC). There are seven European directives that can be considered of significance to the EIA for the project including;

- Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (the EIA Directive)
- Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (the IPPC Directive)
- Directive 2003/35/EC of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC (the Public Participation Directive)

- Directive 2001/80/EC of 23 October 2001 on the limitation of emissions of certain air pollutants into the air from large combustion plants (the Large Combustion Plant Directive (LCPD))

- Directive 1999/32/EC of 26 April 1999 relating to the reduction in the sulphur content of certain liquid fuels and amending Directive 93/12/EEC (the Fuel Oil Sulphur Content Directive)

- Directive 1992/43/EC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive)

- Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (the Air Quality Directive).

The EIA Directive sets the thresholds for projects that require an EIA and also outlines the impacts on the environment to be assessed in the EIA process. With regards to power projects it is mandatory that all those with a thermal input of greater than 300 MW shall be subject to an EIA, as is the case with the proposed power station. This has been implemented in UK legislation via the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000.

The purpose of the IPPC Directive is to achieve integrated prevention and control of pollution arising from certain potentially polluting processes. Measures are laid down to prevent or, where that is not practicable, to reduce emissions in the air, water and land in order to achieve a high level of protection of the environment as a whole whilst having regard to BAT. With regards to power projects, combustion installations with a rated thermal input of greater than 50 MW are subject to the IPPC Directive therefore an application for an IPPC permit is required for Tees REP. In addition to the IPPC Directive, the EPR (formerly PPC) application for the plant will draw from the UK's IPPC Sector Guidance Note for Combustion Activities. The IPPC Directive has been implemented into UK legislation via the under the Environment Agency Environmental Permitting (England and Wales) Regulations 2007 and previous to this the Pollution Prevention and Control Act 1999 and the Pollution Prevention and Control (England and Wales) Regulations 2000.

The Public Participation Directive implements the obligations arising from the Århus Convention and amends the EIA and IPPC Directives to improve public participation. The amendments require information provided to "the public concerned" to also be provided to non-governmental organizations charged with the protection of the environment. In addition any supplementary voluntarily information submitted following the submission of the ES would be subject to the same public consultation as the original ES. Finally, following determination of the application, information about the public's participation and the right to challenge the validity of the decision must be made publicly available. These changes came into effect in the UK from 25 June 2005 by amending existing regulations for EIA and through the Pollution Prevention and Control (Public Participation) (England and Wales) Regulations 2005.

The purpose of the LCPD is to limit the emissions of certain pollutants into the atmosphere from large combustion processes. The LCPD applies to combustion plants with a rated thermal input equal to or greater than 50 MW and therefore will apply to the proposed plant. The emissions of nitrogen oxides,

sulphur dioxide and particulates will therefore be subject to the stringent limit stipulated in the LCPD for biomass fired power plant. The Large Combustion Plants (England and Wales) Regulations 2002 implemented the Directive in UK regulations and also provided for amendment of the Environment Agency Environmental Permitting (England and Wales) Regulations 2007.

The sulphur content of certain liquid fuels is limited by the Fuel Oil Sulphur Content Directive with the purpose of reducing the emissions of sulphur dioxide resulting from the combustion of the fuels thereby reducing the potential harmful effects of such emissions on human health and the environment. The directive is applicable to heavy fuel oils and gas oils, also known as distillate fuel oil and biofuels, therefore the fuel oil used by the plant during start up will be subject to the conditions of this directive. The directive is implemented in UK legislation via The Sulphur Content of Liquid Fuels (England and Wales) Regulations 2000.

The aim of the Habitats Directive is to contribute towards ensuring bio-diversity through the conservation of natural habitats and of wild fauna and flora. Measures taken pursuant to this Directive by the Member States shall be designed to maintain or restore, at conservation status, natural habitats and species of wild fauna and flora of Community interest whilst also taking into account economic, social and cultural requirements and regional and local characteristics. The Conservation (Natural Habitats, etc) Regulations 1994 implemented the Habitats Directive in the UK.

The Air Quality Directive identifies levels for ground level concentrations of pollutants including oxides of nitrogen, nitrogen dioxide, sulphur dioxide and particulate matter that are low enough to guarantee that there are no adverse effects with regard to human health. The directive identifies desired maximum ground level concentrations and the date by which the objectives should be met. The directive is implemented in the UK through the air quality strategy objectives which are discussed further in Section 6.

2.5.1 Planning policy

The ES has been prepared to demonstrate that the Tees REP is not only consistent with the requirements of national planning policy but also at the local and regional level.

At the local level the ES has included consideration of the Local Plan and relevant parts of the emerging Local Development Framework (LDF). Since 1999 the Redcar and Cleveland Borough Council Local Plan has set out the planning policies which will guide and control new development in the Borough. However this document was due to expire on the 27 September 2007 to be replaced by the emerging Local Development Framework unless the Secretary of State directed otherwise.

It is understood that the situation at the time of this application is that the Local Plan remains a part of the statutory approved Development Plan until it is fully replaced by appropriate sections of a formally adopted LDF. At present the LDF “Core Strategy” and “Developments Policy” documents have been approved though the “Communities” and “Economic” LDF components will not likely to be approved until 2010. The Secretary of State has directed that some, but not all of the policies contained within the Local Plan will be retained for future use whilst the remainder of the LDF is prepared. This does not affect the status of the Local Plan as a material consideration in the determination of planning applications but it does mean that the document must be read in context with emerging national and regional policies.

The EIA has therefore taken in to consideration the saved policies of the Local Plan, the available Local Development Scheme documents (including the Core Strategy and Developments policies) adopted in July 2007 and all other relevant supplementary planning guidance applicable to the area.

The ES has also taken into account the policies of the Tees Valley Structure Plan prepared in 1999 by the Tees Valley Joint Strategy Unit which has been adopted by the unitary authorities of Darlington, Hartlepool, Middlesbrough, Stockton-on-Tees and Redcar and Cleveland in 2004 as part of their development plans.

The main planning issues, taken from the Redcar and Cleveland Borough Council Local Plan and the Local Development Scheme, of relevance to the proposed development are discussed further in Appendix C. The policies associated with the area immediately surrounding the development seek to encourage development of the land on which the plant is located.

The Redcar and Cleveland Borough Council has identified the proposed site on their proposals map as being located within an area for economic recovery once promoted by the Teesside Development Cooperation. The site is considered to be located within an area identified as being reserved for industry, such as the proposed plant, that benefit from access to the waterside as promoted by Policy IND 2.

The policies of the following plans have also been taken into account in this Environmental Statement:

- Regional Policy Guidance for the North East (RPG-1); and
- Regional Spatial Strategy of the North East of England Regional Assembly.

At a national level consideration has been given to the following Planning Policy Guidelines (PPGs) and Planning Policy Statements (PPS):

- PPG 1 General Policy and Principles
- PPS 1 Delivering Sustainable Development
- PPS7, Sustainable Development in Rural Areas;
- PPS 9 Biodiversity and Geological Conservation
- PPS 10 Planning for Sustainable Waste Management
- PPS 11 Regional Spatial Strategies
- PPG13, Transport;
- PPG 15 Planning and the Historic Environment
- PPG 16 Archaeology and Planning
- PPG20, Coastal Planning;

- PPS22, Renewable Energy;
- PPG 23 Planning and Pollution Control
- PPG 24 Planning and Noise
- PPS 25 Development and Flood Risk.

The most relevant policy guidance note issued by the UK Government to the proposed Renewable Energy Plant is "Planning Policy Statement: Renewable Energy 2004" (PPS22) and the accompanying "Companion Guide" that specifically relates to renewable energy and planning. These documents replaced the original PPG22 that was issued 1993. PPS22 has been produced to reflect new Government priorities on energy provision as set out in the Energy White Paper (2003). The Companion Guide (finalized in 2005) provides a more in depth discussion of good practice guidance on planning for all mainstream renewable energy technologies.

PPS22 outlines the potential role of renewable energy in reducing the emissions of "greenhouse gases" and combating climate change. The document also discusses how local planning authorities should provide for renewable energy policies in their plan policy and details the issues that will likely apply when considering the merits of a renewable energy project. The guidance notes that:

*"**The wider environmental and economic benefits of all proposals for renewable energy projects, whatever their scale, are material considerations that should be given significant weight in determining whether proposals should be granted planning permission."***

The guidance has been prepared to aid the Government in its aim of cutting emissions of carbon dioxide (CO_2) by some 60 per cent by 2050 with the aim of "real progress" by 2020. This aim is in addition to the Governments objective of generating 20 per cent of UK electricity from renewable sources by 2020.

The PPS22 Guidance note borrows in part from PPG22. However, to assist the Government in achieving its stated aims, the document now includes guidance on the identification by local and regional authorities of areas that might be suitable to house renewable energy projects. The document also advises on the preparation of supplementary planning guidance notes by Local Authorities. There are also new sections requiring the removal of buffer zones, and emphasizing the need for clear, criteria based policies for use in Regional Planning Guidance and Development Plans.

PPS22 states:

"Increased development of renewable energy resources is vital to facilitating the delivery of the Government's commitments on both climate change and renewable energy."

It does however recognize that sites proposed for the development of renewable energy sources will often be located in rural areas and that such development will almost always have some local environmental effects. The document stresses the importance of minimizing any impacts on the surrounding environment.

Planning policies taken from the various Regional and Local Planning documents are replicated and discussed in Appendix C. In no cases were planning policies considered to run counter to the proposed development.

3. NEED FOR THE PROJECT AND BENEFITS

There are three drivers for the construction of a new 300 MWe renewable energy power station at Teesport:

- Climate Change
- Planned closure of about a third of the UK's power station capacity by 2018
- The need to diversify away from oil and gas given historically high and volatile prices.

In recent years, there has been a growing awareness of the need to reduce carbon emissions to slow down the pace of climate change resulting from human activity. The electricity generating industry is one of the major sectors responsible for carbon emissions, and hence climate change and global warming, because generation of electricity has traditionally relied upon burning of fossil fuels.

Between now and the year 2018, about a third of the UK's electricity generation capacity is set to retire as nuclear stations reach the end of their safe operating lives, and improved environmental standards force ageing coal and oil stations to close. It is essential to Britain's economic health that this generation capacity is replaced in a manner that is clean, secure and economically efficient. The planning and construction of new power stations can take at least 5 years (and considerably longer for nuclear power stations), and therefore it is essential that the country starts planning for new power stations now.

While natural gas will continue to play a significant role in meeting Britain's energy needs, it is highly desirable that our sources of energy become more diverse in order to reduce the country's exposure to price volatility and supply interruptions as the UK's North Sea production declines and imports increase. Gas prices are now linked to oil prices due to dependence on European supply contracts, and with global oil prices at historic highs gas prices are trading at over three times the average for the decade.

This section provides an overview of the international, national and local planning and energy policies that have been introduced as a result of these concerns, and illustrates how the Tees Renewable Energy Plant (Tees REP) would help meet these policies.

3.1 Climate change

Climate change is one of the most serious environmental problems faced by the world today. It is internationally recognized that the global climate is changing as a result of increasing levels of 'greenhouse' gases in the Earth's atmosphere. Over the last two centuries global atmospheric concentrations of carbon dioxide have grown by nearly 30 per cent, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15 per cent (United States Environmental Protection Agency). This growth is driven by mankind's increased burning of fossil fuels. These greenhouse gases prevent heat escaping into space, raising the global temperatures as their presence increases.

The 1990s were the warmest decade since records began in 1861. The average global surface temperature has risen by 0.6°C over the 20th century, and could rise by 2.5°C in the next 50 years, and by up to 5.8°C during this century, as a direct result of the greenhouse effect, though the impact on global regions will be varied. In some regions these changes could lead to drought, in others increased flooding. It is already evident that the polar icecaps are receding as the global temperatures rise, which may lead to an increase in sea levels. In the 20th century, records show that the global mean sea level rose by an average of 1-2 mm a year (United Nation (UN) Working Group of the Intergovernmental Panel on Climate Change).

Worldwide the consequences could be devastating with many millions of people exposed to the risk of disease, hunger and flooding. By the middle of the century, 200 million more people may become permanently displaced due to rising sea levels, heavier floods, and more intense droughts.

A report issued by the UK's Office of Science and Technology – Foresight Future Flooding (2004) estimated that by the end of this century, up to 4 million Britons face the prospect of their homes being inundated directly as a result of climate change. In the UK it is likely that our winters will become warmer and wetter whilst our summers become hotter and drier. Extreme weather events will become more frequent.

Climate change is now the greatest long-term threat to wildlife worldwide. The RSPB noted in 1998 that "A staggering number of species could be committed to extinction as a result of climate change – a third or more of land-based plant and animal species by the 2050s if we take no action to limit global warming."

In 2006 the UK Government commissioned the 'Stern Review on the Economics of Climate Change' (**Stern Review**) into the potential impacts of climate change to the UK and global economies. This review concluded that not combating climate change could reduce global gross domestic product (GDP) by 5 per cent year on year 'now and forever' whilst the costs associated with combating global climate change could be as little as 1 per cent of global GDP. The report identified **the investment that takes place in the next 10-20 years** as having a profound effect on the climate in the second half of this century and in the next. It concluded that **"our actions now and over the coming decades could create risks of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century" but that "there is still time to avoid the worst impacts of climate change, if we take strong action now".**

3.2 Policies for tackling climate change

3.2.1 The Kyoto Protocol

In 1997 worldwide Governments took a significant step and agreed on the **Kyoto Protocol,** which upon ratification, would establish legally binding targets for the reduction of greenhouse gases emitted by industrialized countries. Under the Protocol all industrial nations are required to reduce collective greenhouse gas emissions by just over 5.2 per cent from 1990 levels by 2008-12. The European Union, a leading voice in the Kyoto negotiations, agreed to an 8 per cent reduction, which was subsequently shared between the Member States. As part of this the UK Government made a commitment to reduce greenhouse gases by 12.5 per cent by 2008-2012 and, in addition, to move

towards a target of a 20 per cent reduction of carbon dioxide by 2010, with an aspirational target of 60 per cent by 2050. Although the US has not ratified the protocol, the protocol came into force in February 2005.

In December 2005 the Parties to the **United Nations Framework Convention on Climate Change** (UNFCCC) met for the eleventh time, marking the entry into force of the Kyoto Protocol following the enactment of the Protocol into Russian Law. The conference represented a shift in recent climate change discussions with the conference agreeing to negotiations to extend the Kyoto Protocol beyond 2012. The conference also saw the launch of "open and non-binding talks" with countries yet to ratify the protocol including the United States of America (US) a development that represented a significant shift in US Policy. President George W Bush has more recently, in May 2007, followed up this commitment asking nations including China and India to join the US and the rest of the international community in establishing long-term global goals by the end of 2008 and that the US would be cutting its carbon emissions by "10 per cent by 2020" and help to put in place a successor to the Kyoto proposal which will expire in 2012.

3.2.2 European Climate Change Programme

The European Commission (EC) published its **European Climate Change Programme** in 2000 with the aim of meeting the requirements of the Kyoto Protocol. This combined a strengthening of existing measures with a range of new initiatives including a European Union (EU)-wide greenhouse gas **Emissions Trading Scheme ("The EU ETS")** which started in 2005. Promoting the increased use of renewable energy forms one of the cornerstones of the EU's strategy for meeting the Kyoto target, as power generation is major producer of carbon dioxide.

The EU promotes the generation of electricity from renewable energy sources through the **Renewables Directive** (Directive: 2001/77/EC), which required each Member State to commit to specific targets for renewable energy. The promotion of electricity from renewable sources of energy is a high priority in the European Union for several reasons in addition to combating climate change, including the security and diversification of energy supply, environmental protection and social and economic development.

In March 2007 the EU announced its **Climate Change and Energy Package**. This initiative saw the EU set ambitious environmental goals to increase energy efficiency and reduce greenhouse gas emissions by at least 20 per cent by 2020 and to further promote renewable energy sources by setting a minimum EU-wide target of 20 per cent of all energy to be derived from renewable sources. The policy proposed that the UK adopt a binding target of 15 per cent of all energy to be derived from renewables by 2020. It has since been estimated that, if enacted, it would require a minimum of 30 per cent of electricity to be renewable in order to off-set transport and heating fuels which can't easily be switched to renewable sources

The EU has identified the UK, more than any other member state, as needing to make rapid progress if it is to achieve its targets and currently **the UK has a lower proportion of renewable energy than**

any other EU state with the exception of Luxembourg and Cyprus (currently about 4.6 per cent of electricity, including large hydro[1]).

3.2.3 UK Climate Change Programme

The **UK Climate Change Programme,** published in November 2000, set out the Government's proposals for meeting the UK's legally-binding target of a 12.5 per cent reduction in greenhouse gas emissions, (Kyoto Protocol) and for moving towards the Government's domestic goal of a 15 per cent reduction in carbon dioxide emissions by 2020. The programme also confirmed the requirement to supply over 10 per cent of UK electricity from renewable sources by 2010 in line with the Renewables Directive. The UK programme for reducing greenhouse gas emissions includes the **Climate Change Levy**, carbon trading (including the EU ETS), increased energy efficiency and a renewable energy support programme. The Climate Change Levy comprises a tax on the use of non-renewable energy used in industry, commerce and the public sector, with offsetting cuts in employers' National Insurance Contributions. Renewable energy, such as that from the proposed Tees REP, is exempt from this levy.

3.2.4 Renewables Obligation

A key part of the UK's Climate Change Programme is the **Renewables Obligation** (RO), which was introduced in April 2002. The Obligation requires licensed electricity suppliers to source specified percentages of the electricity that they supply from renewable sources. The level of the RO is set to increase each year from 9.1 per cent for 2008-9 to reach 15.4 per cent by 2015-16. The scheme will remain in place until at least 2027.

In the 5 years that the RO has been in force it has proved a positive incentive in bringing forward new renewables generation and in encouraging investment. The RO is expected to create extra demand for renewable energy worth £1 billion per annum by 2010. More new capacity was installed during the first 2 years of the schemes operation than in the previous decade.

In February 2003, **The Energy White Paper "Our energy future – creating a low carbon economy**", was issued, setting out the Government's energy policy on renewable energy and confirming the target of over 10 per cent electricity to be supplied from renewable sources by 2010, and including an ambitious target of 20 per cent of the UK's electricity supply to be met by renewables by 2020. **The White Paper encouraged local planning authorities to promote renewables through the planning system** and also notes "Renewable energy will also play an important part in reducing carbon dioxide emissions while also strengthening energy security and improving our industrial competitiveness as we develop cleaner technologies, products and processes."

The targets for renewable energy generation in the UK were reaffirmed in '**Meeting the Energy Challenge - A White Paper on Energy**' published by the government May 2007. The paper identified the need for significant amounts of additional generation in the UK and again identified the government's aim of generating 20 per cent of the UK's electricity from renewable sources by 2020,

[1] *Department for Business Enterprise and Regulatory Reform – UK Energy in Brief , July 2007.*

and ultimately 60 per cent by 2050. The White Paper also proposes that dedicated **biomass power stations should receive ROCs at the rate of 1.5 times that of onshore wind, signalling the Government's encouragement of this technology**. An industry wide consultation was held on the banding proposal, the results of which were published on January 10th 2008, confirming that the proposal of biomass to receive 1.5 ROCs is widely supported by consultees.

The White Paper also introduces the requirement for sustainability reporting within the RO and promotes the development of sustainability standards.

The **'Renewable Energy Strategy'**, published in **June 2008**, now asks industry and public to consider the implications of increasing the Renewables Obligation to 30 to 35% of electricity sales by 2020 in order to meet the EU targets.

The **Renewable Energy Strategy** also estimates that to in order meet the UK's target's, about 80 TWh of energy from biomass will need to be produced either as electricity or heat., **of which the Tees REP will be able to supply about 2.4 TWh or 3% per centof the Bio-energy target included in the Renewable Energy Strategy**.

3.2.5 Climate Change and Local Planning Policy

Introducing measures to combat climate change into planning policy is set out in the Government's proposed Planning Policy Statement (PPS) 'Planning and Climate Change'. In the section of the PPS document relating to Local Development plans, the advice is that planning authorities should:

- consider allocating sites for renewable and low-carbon energy sources, and supporting infrastructure, taking care to avoid stifling innovation;
- look favourably on proposals for renewable energy including on sites not identified on development plan documents;
- not require applicants to demonstrate either the overall need for renewable energy and distribution or for a particular proposal for renewable energy and therefore to be sited in a particular location; and
- avoid policies that set stringent requirements for minimizing impact on landscape and townscape if these effectively preclude the supply of certain types of renewable energy and, therefore, other than in the most exceptional circumstances, such as within nationally recognized designations, avoid such restrictive practices.

This advice is a clear indication that proposals for renewable energy should be treated favourably by the planning system.

3.2.6 UK Biomass Strategy

The UK Biomass Strategy was published in May 2007 with the Government's White Paper, and meets the commitments made in the **Energy Review (2006**) and the Government's response to the 2005

Biomass Task Force Report. The strategy reflects UK targets and policy objectives while setting out the Government's intention for Biomass.

The strategy emphasizes the Government's wish to increase the use of biomass as an energy source and the important role dedicated biomass plants will have in achieving the target of 10 per cent of electricity from renewable sources by 2010 and 20 per cent by 2020.

In 2006 18 per cent of all renewable electricity came from biomass[2], more than three quarters of which was co-firing (where biomass is mixed with coal and fired in traditional coal boilers).

3.2.7 Local targets for renewables and biomass

Both the Energy White Paper (2003) and the 2002 Energy Review (Performance and Innovation Unit (PIU)) recommended that regional planning bodies become pro-active in planning for energy developments at a sub-regional level. To this end the North East **'Regional Spatial Strategy** (RSS) has been prepared that will, when finalized, replace the current Regional Planning Guidance for the North East (RPG 1); these documents are discussed further in Appendix C, 'Local Planning Policy'.

Policy 40 of the RSS proposes the target of 10 per cent of the region's energy should come from renewable resources by 2010, which equates to 454 MW minimum installed capacity and 20 per cent by 2020.

In 2003 the Government Office for the North East (GO-NE) commissioned the preparation of the draft "North East of England Regional Renewable Energy Strategy" (**draft RRES**). This concluded that meeting the Government's targets would require at least 1500 GWh per annum of locally generated renewable electricity by 2010, rising to at least 3000 GWh per annum by 2020, if the 20 per cent target is adopted. This assumed that growth in electricity use could be halted by effective energy efficiency measures. It was estimated that generating this quantity of renewable electricity in 2010 would reduce the Region's emissions of carbon dioxide by 645 000 tonnes per annum. The study predicted that renewable technologies such as biomass would play an important role in achieving the 10 per cent by 2010 and 20 per cent of the 2020 target.

A review of the **draft RRES** was commissioned in March 2005 and September 2005 to support the RSS during its formal consultation stages in 2006. The review of the **draft RRES** identified two projects using biomass to generate electricity, co-firing at ALCAN in Northumberland and a second dedicated biomass unit at Sembcorp Utilities on Teesside.

The **draft RRES** assumed that beyond 2010 there may be a number of small scale biomass fired CHP plants in the Region. The RRES assumption regarding biomass CHP was reduced in the March and September review, however it was proposed that this should be reconsidered again in the future based on the success of the existing and proposed biomass projects.

[2] *figure includes stand alone biomass, co-firing and farm digestion but not landfill gas, sewage digestion or municipal solid waste.*

3.3 Climate change policy implications for Tees REP

3.3.1 Tees REP contribution to greenhouse gas emissions reductions

Unlike fossil fuels such as gas and coal, **combustion of biomass is "carbon neutral"** because although CO_2 is emitted during the process, the equivalent amount is reabsorbed during the growth of the biomass itself (this is discussed further below). Therefore the chief sources of greenhouse gas emissions in relation to biomass power generation are the emissions released during transport of the fuel from the origin to the power station, and any direct or indirect carbon emissions arising from the establishment, cultivation and harvesting of the biomass fuel.

Emissions from transport

The Tees REP will be situated alongside a deep water import berth, and the majority of the fuel for the power station will be delivered by sea and this is an important source of CO_2 emissions that must be considered. In addition we must also consider that there will still be some land based transport in order to bring the biomass from fields and plantations to the load ports.

Emissions from shipping wood chip fuel, even over long distances, are very small when compared with the energy contained within the wood chip. According to DEFRA guidelines[3] about 7 kg of CO_2 are emitted for every 1000 km of bulk transport by sea in large bulk vessels per tonne transported. That equates to about 10 kg of CO_2 emitted from sea transport from the European Union and 45 kg CO_2 emitted per tonne of biomass shipped from North America.

For transport between the biomass land origin and the load port, the maximum practical distance is about 200 km. Therefore we assume an average road transport distance of 100 km, and again using the DEFRA guidelines for emissions, this equates to 4.2 kg of CO_2 emitted per tonne of biomass. In North America and other countries where significant rail transport exists, there is an opportunity to further reduce land transport emissions of carbon dioxide by a factor of 40 per cent by replacing road haulage with rail.

Table 3.1shows estimated emissions of CO_2 from biomass transport for delivery to Tees REP, using conversion factors provided by DEFRA.

[3] *http://www.defra.gov.uk/environment/business/envrp/pdf/envrpgas-annexes.pdf, 17 June 2008*

TABLE 3.1
EMISSIONS OF CO_2 FROM BIOMASS TRANSPORT

Origin	***Emissions from land transport***	***Emissions from sea transport***	***Total***
North America (Eastern Seaboard) 6500 km	*4.2 kg CO_2 per tonne of biomass*	*45 kg CO_2 per tonne of biomass*	*49.2 kg CO_2 per tonne of biomass*
European Union (eg Baltic) 1400 km	*4.2 kg CO_2 per tonne of biomass*	*10 kg CO_2 per tonne of biomass*	*14.2 kg CO_2 per tonne of biomass*
Average	*4.2 kg CO_2 per tonne of biomass*	*27 5 kg CO_2 per tonne of biomass*	*31.7 kg CO_2 per tonne of biomass*

Emissions from cultivation and harvesting

CO_2 emissions from cultivation of woody biomass crops are derived mainly from the energy inputs used to make the small amounts of fertilizer and other agrichemicals which are typically required at the time of planting and in the first year of growth. Other carbon emissions from cultivation include the fuel for the vehicles used during planting.

CO_2 emissions during harvesting are attributable to the fuel consumed by the machinery used for harvesting and chipping of the woody biomass.

The figures shown in Table 3.2 below are based on short rotation coppice and are taken from Elsayed et Al. [4]

TABLE 3.2
EMISSIONS OF CO_2 DURING CULTIVATION AND HARVESTING

	Carbon Emissions
Cultivation	*18 kg of CO_2 per tonne of wood chip at 25 per cent moisture*
Harvesting and Chipping	*8 kg of CO_2 per tonne of wood chip at 25 per cent moisture*
Total	*26 kg of CO_2 per tonne of wood chip at 25 per cent moisture*

[4] *Elsayed, M.A., Matthews, R. and Mortimer, N.D. Carbon and Energy Balances for a Range of Biofuel Options" Energy Technology Support Unit, Harwell, United Kingdom, Report B/B6/00784/REP, March 2003.*

Comparison of emissions to conventional generation

The alternative (competing) fuel sources most likely to be utilized in the UK are coal in the short term (in existing coal fired power stations) and natural gas in the medium term (in newly constructed CCGTs). Due to the steep decline in indigenous production of natural gas, the marginal source of gas is likely to be Liquefied Natural Gas (LNG) from countries such as Qatar and Australia. Tees REP can thus be seen as an alternative to these options, and one with dramatically less carbon emitted over the lifetime of the project.

Table 3.3 shows the comparative expected lifecycle emissions of biomass generation at Tees REP along side those for coal generation where the coal is imported from South Africa and gas generation using LNG imported from Qatar.

TABLE 3.3
EXPECTED LIFECYCLE OF EMISSIONS COMPARED AGAINST OTHER FORMS OF GENERATION

	Upstream emissions	Transport emissions	Combustion emissions	Total	Emissions per MWh of electricity exported
Biomass	26 kg CO_2 per tonne of biomass	32 kg CO_2 per tonne of biomass	None	58 kg CO_2 per tonne of biomass	42 kg CO_2 per MWh
Coal	43 kg CO_2 per tonne of coal[5]	79 kg CO_2 per tonne of coal	2,257 kg CO_2 per tonne of coal	2379 kg CO_2 per tonne of coal	939 kg CO_2 per MWh
Natural Gas[6]	65 kg CO_2 per 13 GJ of gas[7]	182 kg CO_2 per 13 GJ of gas[8]	741 kg of CO_2 per 13 GJ of gas	988 kg of CO_2 per 13 GJ of gas	464 kg CO_2 per MWh

Note: Thermal efficiencies: Biomass, Coal 38%; Gas CCGT 59%. Net Calorific values Coal 24 GJ/tonne, Biomass at 25% moisture 13 GJ/tonne. Natural Gas units of per 13 GJ chosen to match the energy content of biomass for ease of comparison.

Chart 3.1 displays the cumulative CO_2 emissions resultant from power generated by biomass at Tees REP, alongside emissions from coal and natural gas for the same sized facility. *Note: output is 2.43 TWh/yr (300 MW for 8100 hrs/yr).*

[5] *Emissions from coal mining, source: J.E. Berry, M.R. Holland, P.R. Watkiss, R. Boyd and W Stephenson. Power Generation and the Environment - A UK Perspective. AEA Technology Environment Report AEAT 3776, 1998*

[6] *Derived from figures taken from Comparative Life Cycle Carbon Emissions of LNG Versus Coal and Gas for Electricity Generation Paulina Jaramillo, W. Michael Griffin, H. Scott Matthews*

[7] *Includes emissions from production and processing*

[8] *Includes emissions from liquefaction, transport, re-gasification and distribution*

CHART 3.1
CUMULATIVE CO_2 EMISSIONS

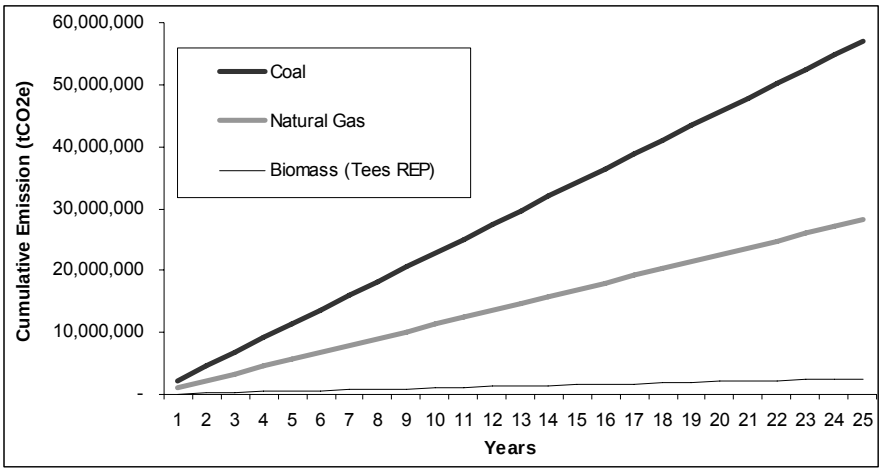


Table 3.4 shows the impact that the Tees REP will have on the UK's target emissions reductions. Note in these figures only the direct emissions from combustion have been considered.

TABLE 3.4
CARBON SAVINGS ACHIEVED BY TEES REP RELATIVE TO COAL AND NATURAL GAS

Alternatives to Tees REP	Emissions avoided per year due to Tees REP (tonnes CO_2e)	Emissions avoided as % of UK's Carbon Reduction Target
Coal	2,067,191	6.4
Natural Gas	928,552	2.9

Note: UK CO2 reduction target (20% of 1990 emissions) 32.2 million t CO2e9. Source: UK Govt, IEA, UBS.

The considerable environmental merits of this project stem from the largely carbon neutral nature of MGT's fuel supply. Source countries will be selected on the basis of effective internal biomass trade regulations, so there can be confidence that any harvest and emissions are netted out by subsequent re-growth and sequestration. MGT will establish long term contracts that encourage sustainable management of forest stands, and use of sustainable and certified biomass will be a condition placed on MGT as part of the planning consent for the Tees REP.

MGT has stated that it welcomes the adoption of life cycle fuel carbon accounting systems as a way of increasing transparency and demonstrating the credentials of the Tees REP in comparison to fossil fuel generators.

[9] *DEFRA 2006 – UK Emissions of Greenhouse Gases*

3.3.2 Biomass land use considerations

MGT is committed to ensuring that all biomass is certified using independent, internationally recognised standards for example those provided by the FSC (Forest Stewardship Council). Certification standards will include criteria for best practise management of wildlife, positive-impact social policy and measurement of carbon lifecycle emissions as well as sustainability of forest production. It is expected that the use of sustainable and certified biomass will be a condition placed on MGT as part of the planning consent for the Tees REP.

Fuel from existing plantations

As sourcing fuel from an existing plantation does not involve a significant change in land use regime for these areas, no direct negative environmental impact is foreseen in this instance. The creation of additional demand for wood products from these areas will in fact reinforce the permanency of the land use regime, and thus enhance the longevity of the carbon storage upon that land, in plants and soils etc. Permanency is reinforced by the long term nature of the Tees REP. As the plant is expected to be operational for many decades, it will require sources of fuel that can be relied upon over the long term.

Fuel from new plantations

Globally increasing biomass demand can potentially bring about positive change environmentally, not just through displacing fossil fuel energy, but also through establishment of new forestry plantations, creating enhanced carbon storage on land. MGT support responsible regulation to prevent deforestation of virgin forest to create such plantations and in addition MGT will select biomass source countries based on the strength of their effective internal biomass trade regulations.

The Tees REP will be “project financed”, meaning the project will borrow money from large international banks to finance the £400m construction cost. These loans are repaid over long periods of up to 25 years and this necessitates the establishment of long term, low-risk fuel supply arrangements with reputable forest companies, able to pass strict lenders due diligence criteria.

One example of wood demand stimulating forest expansion is the south east USA, where area under plantation is expected to expand 40 per cent over the next 35 years, with consequent benefits for wildlife and permanent carbon sequestration on the land[10].

MGT looks to the latest and best scientific research regarding the carbon dioxide consequences of changing land use patterns. Fargione[11] showed that “**biofuels made from waste biomass or from biomass grown on abandoned agricultural lands planted with perennials incur little or no carbon debt and offer immediate and sustained GHG advantages**.”

[10] *The Possibility of Plantations: Integrating Ecological Forestry into Plantation Systems, National Wildlife Federation (U.S.A.), May 2006*

[11] *Fargione 2008, Land Clearing and the Biofuel Carbon Debt, Science Express*

We note this as a unique environmental merit of cultivation for biomass, and contrast this with the negative impacts currently occurring as a result of food crop cultivation for first generation biofuels, which often compete with agricultural crops for land space. As the Tees REP is more flexible, in terms of which species it can utilize, and the specific parts of the crop/tree to be utilized, compared to conventional food-crop agriculture or pulp and paper agro-forestry, it allows not only enhanced utilization of existing land under plantation, but also greater utilization of marginal land space. In particular it involves the planting of species which are "likely to be more environmentally benign"[12].

3.4 UK Electricity Supply

The UK faces the closure of approximately 19 000 MW of electricity generating capacity between now and 2018 (see Table 3.5). In addition to this approximately 2500 MW of new generation capacity will be required to meet increasing demand by 2020 according to the National Grid Company[13]. Therefore a total of about 21 500 MW of additional capacity must be built by 2020, equivalent to almost a third of existing capacity, in order for the system to stay in balance.

Strict new European emissions standards[14] have meant that coal and oil generators must fit expensive new equipment to dramatically reduce emissions of gases that cause acid rain. In some cases it was not economically possible to fit this equipment and under EU rules these power stations must close by 2015 at the latest. This will force the closure of just over 8,000 MW of coal power stations and 4,300 MW of oil fired power stations.

In addition, Britain's fleet of nuclear generators faces gradual decline as each station reaches the end of its safe operating lifetime. The remaining Magnox stations (Oldbury and Wylfa) will close by 2010, whilst British Energy estimates[15] that Hartlepool and Heysham 1 will end operations in 2014, Hinkley Point B and Hunterston B in 2016, and Dungeness B in 2018. In total over 6,500 MW will be lost by 2018. Table 3.5 summarizes the planed closure of UK Power generation capacity between now and 2018.

[12] *Somerville 2006, Energy from Biomass (presentation)*

[13] *http://www.nationalgrid.com/uk/sys_06/chap2/images/fig2-5.gif, National Grid Base demand forecast*

[14] *Large Combustion Plant Directive*

[15] *http://www.british-energy.com/, 17 June 2008*

TABLE 3.5
PLANNED CLOSURE OF UK POWER GENERATION CAPACITY

Generation Type	***Capacity***	***Closure Date***
Nuclear (Magnox)	*1,400 MW*	*2010*
Nuclear (BE)	*2,350 MW*	*2014*
Coal	*8,000 MW*	*2015*
Oil	*4,300 MW*	*2015*
Nuclear (BE)	*1,700 MW*	*2016*
Nuclear (BE)	*1,090 MW*	*2018*
Total	***18,840 MW***	

The majority of new power stations to be constructed are expected to be Combined Cycle Gas Turbines (CCGT) fired by natural gas. Over 6000 MW of CCGT capacity has recently received Section 36 consent from the government for construction and operation and a further 7000 MW is currently under consideration, although not all consented capacity will go on to be developed.

There is currently about 1300 MW of wind energy under construction in the UK, a further 5300 MW has received consent for construction to go ahead and there is about 9600 MW awaiting planning permission (although wind energy has a relatively high rate of planning failure due to high visual impact). However while wind energy will make a valuable contribution in terms of total energy production, none of the existing or planned capacity can be considered as firm and reliable power capacity from a security of supply perspective due to the intermittency of the wind resource.

Only one Section 36 application has so far been made in respect of new coal plant for the UK, made by EOn for their 1600 MW site at Kingsnorth. The plans face considerable local, national and international opposition from groups committed to fighting climate change. New coal stations are highly undesirable as they produce more carbon emissions than any other form of power generation.

So far the government has received no applications to build new nuclear power stations, although EDF of France has stated its intention to build at least one new nuclear plant by 2018.

Therefore, natural gas can clearly be expected to play a much bigger role in the mix of electricity generation in the future. In 2007 gas met approximately 43 per cent[16] of the UK's electricity demand and this looks set to increase to 60 per cent or more by 2020. However the UK's production of gas is now falling year on year, having peaked in 2000. In 2007 the amount of gas produced by the UK was 9.8 per cent lower than in 2006. The UK became a net importer of gas in 2004 and in 2007 the UK imported over 21 per cent of the gas flowing into the pipeline system. If current trends continue the

[16] *http://www.berr.gov.uk/energy/statistics/source/electricity/page18527.html, DUKES 5.4 fuel used in generation*

UK will be importing over 80 per cent of its natural gas requirements by 2020. This level of energy dependence has never been experienced before by the UK, it will be important to ensure that sources of energy are as diverse as possible, both geographically and by fuel type in order to ensure security of supply.

3.5 Policy relating to UK electricity supply

3.5.1 'Meeting the Energy Challenge - A White Paper on Energy'

The 2007 Energy White paper officially recognizes the need to replace retiring power generation capacity in the UK stating:

"If we are to maintain levels of electricity generation capacity equivalent to those available today, then new power stations need to be built in good time to replace these closures and to meet increases in demand. On this basis, around 20-25 GW of new power stations will be needed by 2020"

Furthermore the White Paper acknowledges the need for diversity in the supply of fuel:

"*Having a diverse supply of energy is an important factor in security of supply. This can mean both diversity in the type of fuel used, and also diversity in the geographic distribution of fuel sources. Avoiding over-dependence on single sources lessens the impact of "technology failure" or supply chain interruptions."*

The White Paper also includes proposals to strengthen the Renewables Obligation in order to encourage the construction of more renewable generation capacity (discussed in section 3.2.4 above). In particular biomass generation was given additional encouragement by the proposals to increase the level of RO support by 50 per cent.

3.5.2 The Planning Bill

Following proposals made in the White Paper (2007), the Government introduced a Planning Bill to the UK Parliament on 27 November 2007. Presently, the Bill is being debated in the House and Lords and is expected to be given Royal Assent later this year.

The Purpose of the Bill is to streamline planning applications for all major infrastructure projects which are considered of national importance. The Bill proposes a new system of Development Consents for nationally significant projects. This will entail an Independent Planning Commission (IPC) and a new national policy framework, otherwise known as National Planning Statements (NPS).

Applications for Development Consent for transport, energy (include nuclear power), water and waste infrastructure will be determined by the IPC. The IPC will decide any application where a relevant National Policy Statement is in place. The IPC will have the power to grant decisions with conditions attached, subsequently, the Secretary of State will no longer be involved in the determination of major infrastructure projects.

NPS will comprise of various statements which will set out the Government's proposals for meeting the country's key infrastructure requirements. NPS will set out clear guidance on the size and nature

of projects and will become the primary consideration for the IPC in determining applications. Where relevant planning statements already exist, these will become NPS.

3.6 Electricity supply policy implications for Tees REP

3.6.1 New UK power generation capacity

The Tees REP, when it comes on line in 2012 will supply enough electricity to power about 600,000 UK households. At 300 MW of net power export, it will represent 1.4 per cent of the 21,500 MW of new power capacity that the UK needs to build by 2020 (a measure of the scale of the task facing the UK in constructing this capacity).

Unlike wind generation which typically only produces about a third of its potential output due to variability to the variability of the wind resource, the Tees REP will produce power about 91 per cent of the time, providing a secure supply of energy to the grid, and ensuring maximum use of the site.

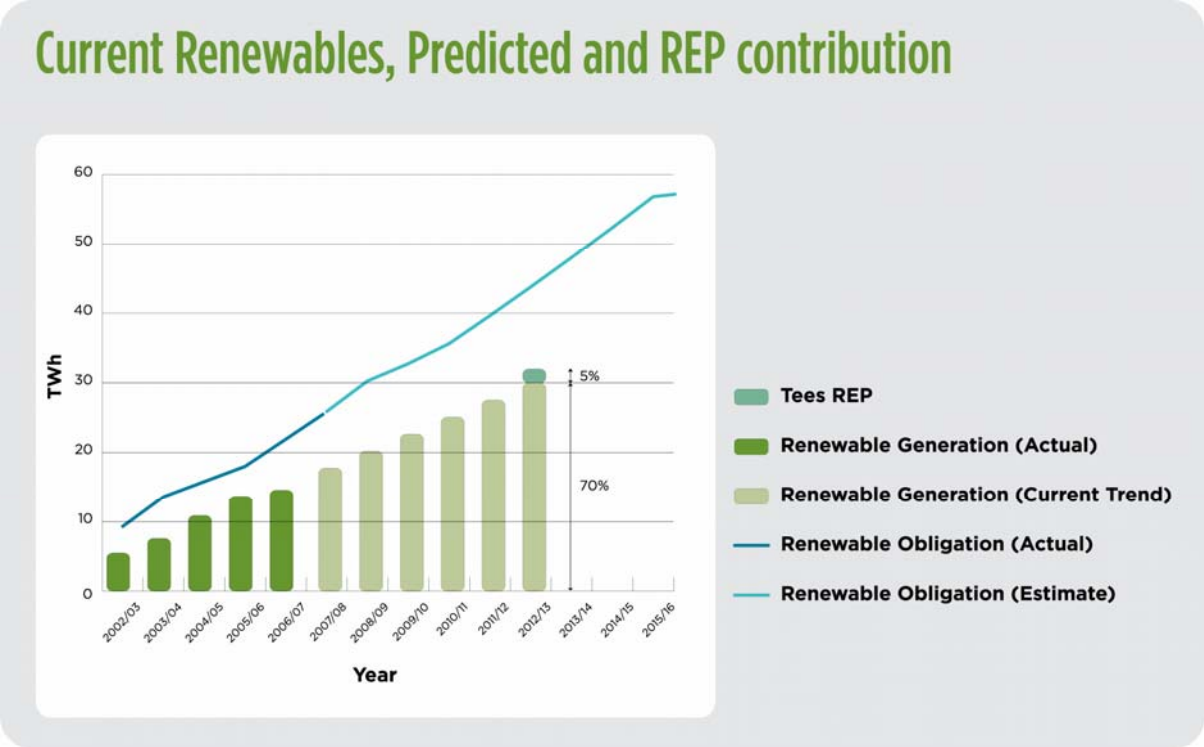
As a baseload generator, it will produce approximately 0.6 per cent of the country's power consumption per year from 2012, whilst providing valuable diversity from the traditional fuels of coal, gas and nuclear, all of which will rely strongly on imports by 2012.

3.6.2 Contribution towards UK renewables targets

The Tees REP will make a valuable contribution to meeting the government's targets for renewable energy. Renewable Energy is desirable partly to reduce emissions of greenhouse gases, but has other significant benefits as a way of diversifying energy sources and reducing dependence on finite fossil fuels which one day will not be able to supply the world's energy needs. Chart 3.2 shows the contribution that the Tees REP will make towards the government's Renewables Obligation.

Tees REP will help ensure that the North East RSS targets for Renewable Energy are met both in 2012 (when the plant will come on line), and in 2020 assuming the 20 per cent target is introduced. The Tees Valley sub-regional target will also be met comfortably.

CHART 3.2
CONTRIBUTION OF TEES REP TOWARDS THE RENEWABLE OBLIGATIONS



3.6.3 Fuel supply

Biomass for the Tees REP will be mostly sourced under long term contracts with reputable, purpose built energy plantations from a variety of different countries including the UK, other EU states and North America. The cost of the delivered fuel will be stable and will only be very weakly correlated to oil prices (via transport costs). Thus, as a source of primary energy biomass will make a stabilizing contribution to the overall mix.

This is in contrast to natural gas which, as imports increase as a share of UK consumption, is now closely linked to the price of oil via long term European supply agreements which are linked to crude oil indices. Recent UK seasonal gas prices are more than three times as high as the average for the decade from the year 2000, when current the index began. Price volatility has also been at record levels since the Russian/Ukrainian pipeline crisis in the winter of 2005/2006. European coal prices are also at historic highs both in terms of price, and volatility.

3.6.4 Other economic benefits

The development of renewable energy schemes presents an economic opportunity both nationally and at a regional and local level. The "World Energy Council" predicts that renewable energy will lead to the investment of some £400 bn to the Global economy between 2000 and 2010. A study undertaken by the Department for Trade and Industry (now known as BERR), the 'Renewables Supply Chain Gap Analysis' found that in 2004 just 8000 people were employed by the renewable energy industry in the UK. The study concluded that by 2020 there is the potential to create between 17 000 and 35 000 new jobs in the sector.

The potential for investment in new and emerging renewable energy technologies must also be seen against the potential impacts of not taking action to combat climate change. The 'Stern Review' of November 2006 concluded that climate change could perhaps reduce global GDP by 5 per cent year on year 'now and forever' whilst the costs associated with combating global climate change could be as little as 1 per cent of global GDP. The report concluded that "our actions now and over the coming decades could create risks of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century." The risks to the UK economy if the Stern Review predictions are correct are plain to see and it is considered that it is through projects such as the proposed Tees REP that this threat can be combated.

Locally MGT will strongly encourage the contractor who will construct the project to use locally sourced materials and locally based contractors as part of their proposals so as to maximize the benefit to the local economy (see further discussions in Section 12). Local companies that have already expressed interest in involvement in the construction and operational phases include AMEC (Darlington), Foster Wheeler (Middlesbrough), Kvaerner (Stockton on Tees), and PX Power (Middlesbrough).

4. PROJECT AND SITE DESCRIPTION

This section describes why MGT Teesside Limited (MGT) are undertaking the development, the options available in terms of technology and location, and provides a detailed description of the proposed Tees Renewable Energy Plant (Tees REP).

4.1 Site selection

The new plant will be constructed on land adjacent to the Teesport docks on the south bank of the River Tees. There are many advantages of the proposed site that make it an ideal location for power generation. These include amongst others:

- Its long distance from residential receptors;
- Proximity to deep water and available quay facilities for the planned reception of panamax vessels containing 40,000 tonnes of wood chip fuel;
- The close proximity of the high voltage National Grid transmission line which runs directly along the application site boundary;
- Transport infrastructure that will readily accommodate construction traffic including roads and rail;
- Availability of sufficient land in an area zoned for industrial use;
- Ship unloading and fuel transfer facilities;
- Reduced visual impact due to the industrial nature of the area; and
- Proximity of site to potential heat and power off-takers.

It is therefore considered that the proposed site is suitable for the intended use of power generation.

4.2 The site

The site location is shown on Figure 4.1, a more detailed location plan than Figure 1.1. The Ordnance Survey (OS) Grid Reference of the centre of the site is approximately 454300, 523230. The site is located on 14 ha of land within the Teesport landholding approximately 5 km east of Middlesbrough and 6 km west of Redcar. The site falls within the jurisdiction of Redcar and Cleveland Borough Council in the county of Tees Valley.

The Teesport Estate, in which the Project site is situated, is an industrial area, and is one of the few natural deep water tidal facilities in the UK, and is the second largest port in the UK, in terms of tonnage. The port handles over 50 million tonnes of cargo a year. The area surrounding the site of the proposed development is a busy industrial area with associated heavy 24 hour traffic flows on the A66, A1053, A1085 and A174.

On the eastern side of the site there is an existing steel framed warehouse and Tees Dock quay. The works in the steel framed warehouse are now undertaken on the adjacent quay, making the building redundant. Prior to this project's works commencing, the warehouse will be dismantled and its land area leased to MGT. Cleveland Potash operates on the opposite side of Tees Dock (the eastern side) where they handle and store dry bulk products.

To the west of the proposed site is a tank farm owned by SABIC (previously Huntsman Chemical) which is used for the storage of various chemicals such as Benzene, Xylene, Paraxylene and Butadiene. There are a series of pipelines associated with the tank farm that run around the perimeter of the site.

The Site is well served by A roads and is directly connected to the A66 which is a primary road for access to the site and which leads to the A1. The Teesdale Way, a long distance footpath, runs to the north of the A1085, between various heavy industrial developments.

Historically the site was occupied by an undeveloped intertidal foreshore of open sands, associated with the banks of the River Tees that was reclaimed by 1950 through to 1965 with the site housing a number of storage tanks and associated buildings. The site was at one time bisected by the Kinkerdale Beck which was culverted in 1994. The tanks associated with the oil refining operations on site were demolished at the same time with the exception of six tanks still present in the south eastern corner of the site.

The underlying geology is indicated to comprise made ground underlain by estuarine and marine alluvium drift deposits. The underlying bedrock is understood to comprise Mercia Mudstone underlying Sherwood Sandstone Group is classified as a major aquifer.

The ground water level is present close to the surface and varying depending upon the tide. Groundwater underlying the site is likely to be in hydraulic continuity with the River Tees and is likely to flow in a northwards/north-eastwards direction.

The terrain surrounding the site is typical of that found in surrounding area, being flat and of an elevation of the order of 5 m AOD. The area is dominated visually by the surrounding industry.

A full flood risk assessment has been undertaken for the project as required by PPS 25 and is included in Appendix D. Environment Agency (EA) flood maps indicate that the site is partially located within Flood Zone 3a. Developments in Flood Zone 3a are described as being *"at high risk of flooding if flood defences are not present".* Land is this zone is assessed as having a 1 in 100 or greater annual probability of river flooding (>1 per cent) or a 1 in 200 or greater annual probability of sea flooding (>0.5 per cent) in any year. The flood map also indicates that the site does not currently have any flood defences in place.

MGT has explored the opportunities for Combined Heat and Power (CHP), including community heating, in developing their proposals. At this stage in the development process, only the SABIC chemical storage site to the west of the site has been identified as a potential user of steam from the proposed Tees REP. While SABICs demand for steam is relatively small, MGT will continue to consult with SABIC as the development progresses in case their demands change.

The potential for palaeo-environmental remains and remains of all archaeological eras is considered low at the site with the exception of the modern era, for which the potential is high, although modern remains are considered to be of negligible importance.

There are no footpaths or other such rights of way across the proposed site or indeed within 1 km of the proposed site.

The site sustains little by way of ecological habitat. The nearest designated ecological site is the 'Tees and Hartlepool Foreshore & Wetlands' Site of Special Scientific Interest (SSSI), which lies 1 km to the west though there are a number of other SSSI within 3 km of the site. In addition the 'Teesmouth and Cleveland Coast' SSSI/RAMSAR site/Special Protection Area (SPA) is located 1.2 km to the north-east of the site.

4.3 Alternative sites

There are very few alternative sites that would be capable of supporting the presence of a power station the size of the Tees REP without the need for extensive works to install significant distances of new transmission lines and water supply pipelines.

Renewable Energy Biomass Plants requiring large quantities of imported fuels are best located on the coast within existing Port developments, preferably on existing port land area that is underutilized. This minimizes the need for further port development or modifications and significantly reduces the impact on the road network. In addition to transportation benefits such sites nearly always have an existing electricity grid connection with large areas of brownfield land ideal for power projects.

There are limited locations within the UK where such conditions are known to exist. MGT looked at a number of locations, these being:

- Hunterston Port, West Central Scotland;
- Immingham Port, Humberside;
- Teesside Port, North East England;
- Bristol Docks, South West England; and
- Kingsnorth, South East England.
- Milford Haven, S Wales
- Canvey Island, River Thames

In selecting a site, MGT considered the following factors:

- **Existing deep water jetty facilities** - the site must be in close proximity to a deep water jetty or deep water harbour capable of accommodating a Panamax size vessels (ie c. 14 m draft);

- **Ship unloading and fuel transfer facilities** – ideally facilities must already be in place to accommodate the transfer of fuel from the ships to the development site;
- **Electrical connection** - a 275 to 400 kV electrical connection, with sufficient underutilized transmission capacity, must be available to connect the plant to the electricity transmission system;
- **Land availability** – a sufficient area of land must be available where the landowner is prepared to enter into commercial negotiations for a long-term lease;
- **Site character** –the development must not significantly alter the character or nature of the area and its immediate surroundings;
- **Landowner support** - support of the landowner is essential in order to develop and retain a long-term relationship throughout the life cycle of the plant;
- **Road access** - adequate access to the site from the national road system is required, to facilitate access during construction and access for operational staff and maintenance deliveries;
- **Rail access** – ideally a site has existing rail head which will enable the environmentally friendly delivery of biomass;
- Proximity to industrial heat users; and
- Ideally, proximity to a CO_2 sequestration system

After considering all the sites MGT concluded that the best location for a further renewable energy biomass plant was Teesport. The Teesport site was preferred due to land availability close to the main docking facilities, easy access to the electrical transmission system and good access to road and rail transport links.

4.3.1 Choice of plant

There are a number of technologies available for biomass fired steam generation including:

- Circulating fluidized bed (CFB) combustion;
- Bubbling Fluidized Bed (BFB) combustion.
- Pulverized fuel (PF) combustion;
- Integrated gasification combined cycle (IGCC); and
- Gasification with firing in gas boilers.

4.3.1.1 Circulating fluidized bed combustion (CFB)

Combustion in circulating fluidized bed (CFB) takes place at temperatures from 800-900°C. Circulating beds use a higher fluidizing velocity with the particles being constantly suspended in the flue gases, and pass through the main combustion chamber and into a cyclone, from which the larger particles are extracted and returned to the combustion chamber. Individual particles may recycle anything from 10 to 50 times, depending on their size, and how quickly the char burns away. Combustion conditions are relatively uniform through the combustor, although the bed is somewhat denser near the bottom of the combustion chamber. There is a great deal of mixing, and residence time during one pass is relatively short; however a particle residence time of 20 seconds is achieved on average. CFB boilers are particularly well suited to burning biomass as they allow for firing on larger wood chips that is the case for the alternative boiler and plant designs.

The Environment Agency has recognized that fluidized bed technology has inherent environmental benefits because, as the combustion temperatures are generally lower than typical temperatures experienced in pulverized boilers, lower NO_x emissions are also achievable[17].

4.3.1.2 Pulverized fuel combustion (PF)

In a pulverized fuel boiler plant the fuel must be pulverized to a fine powder and then blown with part of the combustion air into the boiler through a series of burner nozzles. Combustion takes place at temperatures from 1300-1700°C depending largely on fuel though this can be reduced to combat the formation of thermal oxides of nitrogen (NO_x). Particle residence time in the boiler is typically 2-5 seconds, and the particles must be small enough for complete burnout to have taken place during this time.

The technology is used extensively across the world, accounting for well over 90 per cent of coal-fired generating capacity but is not used with wood fuels due to the huge power required to “mill” or grind the wood down into the small particles needed for high speed combustion.

4.3.1.3 Integrated gasification combined cycle (IGCC)

IGCC plants are fuelled on ‘syngas’ derived from the gasification of fuels such as biomass. The syngas is made up of carbon monoxide and hydrogen and is burnt in a combined cycle gas turbine plant designed to allow for proper combustion of this gas.

The plant would consist of a gasifier, air separation unit to provide oxygen to the gasifier, Syngas clean up including removal of hydrogen sulphide and Claus process to produce sulphur or other saleable by-product, gas turbine, heat recovery steam generator (HRSG), steam turbine generators.

For traditional “dirty” fuels, like coal, integrated gasification plants offer environmental benefits but at greatly increased capital cost when compared to more conventional combustion technology. The operational experience of these plants is also relatively limited. There are few environmental benefits to IGCC when using a clean fuel like virgin wood chip.

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[17] *Reference Document on Best Available Techniques for Large Combustion Plants, May 2005, European Commission.*

4.3.1.4 Gasification with firing in gas boilers

Gasification affords a potentially higher efficiency and so it is this method, which has attracted the higher level of interest. Gasification processes have the potential to be more efficient than conventional combustion processes, primarily because the higher temperatures reached in the gas turbines and gas engines allow higher efficiencies to be achieved than is possible with steam plant.

Gasification plant are however still unreliable and are not considered to be a viable alternative for the proposed REP when compared to CFB.

4.3.1.5 Conclusion

It is considered that the best alternative for the main plant is the use of a CFB boiler plant as this represents a cost effective and environmentally sound means of burning the biomass fuel.

4.3.2 Choice of renewable generation type

There are a number of options available for the generation of 300 MWe. These include renewable energy such as biomass, or waste to energy, wind or photovoltaics; nuclear power or fossil fuelled power plant. As the aim of the project is to provide a source of renewable energy in order to help meet Government targets, generation by nuclear power or fossil fuelled power plant and waste to energy plants can be discounted from consideration.

To provide 300 MWe from wind turbines would require of the order of 150 tall turbines to provide the same nominal power output. However, in the UK the average capacity factor for wind turbines is around 30 per cent. This means that over the year a turbine would produce 30 per cent of the amount of electricity it could theoretically produce if it was working at full output all through the year. Therefore the target of 300 MWe would not be met and other electricity generators would be required to meet the shortfall. Turbines providing a nominal 300 MWe would, in any case, require up to 2500 hectares. Although, 99 per cent of this land could still be used for productive farming, the tall wind turbines would have a visual impact over this vast area. Each turbine would be of the order of 120 m in height. Whilst it is therefore considered that wind turbines will play an important part in reducing green house gas emissions it is not considered that wind energy represents an alternative technology for installation at the proposed site.

Solar photovoltaic panels convert light energy directly into direct current (dc) suitable for charging a battery. However, solar technology is currently unproven and not considered feasible for providing up to 300 MWe in the UK.

Government policy recognizes that there is an increasing need for non-intermittent (ie continuous) forms of renewable power generation, rather than relying solely on the intermittent forms (like solar, hydro, tidal and wind). This is because, when the electricity system is stressed during cold weather, there is a risk of blackouts if a large fraction of the UK power supply is intermittent.

It is considered that a biomass fired power station represents the best alternative for generation of 300 MW of renewable electricity at the proposed Teesport site.

4.3.3 Choice of cooling system

Renewable Energy Plants utilize the heat from the burning of wood chips to generate steam in a boiler. This steam is then used in a steam turbine to generate electricity. The steam leaving the steam turbine is condensed by either water or air, producing condensate that is then reused in the boiler.

Cooling techniques available include:

- once through cooling (direct river or seawater cooling)
- evaporative cooling towers
- hybrid cooling towers
- air cooled condensers (ACC).

In spite of the close proximity to the River Tees it was considered that direct cooling would have detrimental impact on the river. In addition to this abstraction was further discounted due to the cyclic tidal and silt laden nature of the river which would require a significant amount of treatment in any potential cooling system. The use of ACCs will minimize the amount of ground disturbance which will reduce the potential any mobilization of the low level contamination existing beneath the site.

The selection of air cooled condensers as a cooling method Tees REP completely avoids the issues of thermal discharge and abstraction of significant quantities of river water; these are typically major impacts a thermal power plant can have on the local water resources and associated fauna.

The performance of ACCs, as for cooling towers, is dependent on ambient temperature and is also sensitive to prevailing wind direction, gusty conditions and the height and position of buildings and other structures in the vicinity. The plant will be designed to minimize the impact of these sensitivities.

The preferred design for ACC units position the heat exchangers above the fan units, with a top height approximately 40 m above the ground surface. The footprint of ACCs is significantly larger than for wet cooled or hybrid systems.

4.4 The proposed plant

Figure 4.2 shows a schematic representation of the proposed plant.

The combustion technology will comprise a circulating fluidized bed (CFB) boiler. The fluidized bed within which the fuel will be combusted will comprise sand, fluidized by the injection of combustion air at the base of the bed. The velocity of the injected air (about 5 to 6 m/s) will be high enough to carry the bed solids along with it. The hot combustion gases will carry the solid matter through the combustion chamber and into heavy duty cyclones (3 units) where the solids will be separated from the hot combustion gas and recirculated back to the bottom of the main combustion chamber. The hot combustion gas will then flow vertically down through the boiler, raising steam which is subsequently passed to a 300 MW steam turbine.

The combustion temperature of the order of 900°C and residence time of about 20 seconds will both be high enough to ensure high efficiency combustion and therefore low carbon monoxide formation, whilst limiting formation of nitrogen oxides.

It is expected that for the majority of its life the plant will operate at base load, except for essential maintenance and statutory inspections. It will be designed and constructed with an average annual availability design target of at least 93 per cent. The plant will be designed to have an expected operational life of over 25 years.

The hot gases in the boiler generate steam at a high-pressure which drives the steam turbine plant to generate electricity. The approximate efficiency based on the LHV of the fuel will be of the order of 37 per cent. This efficiency rating does not take into account the potential for added efficiency if it proves technically and economically feasible to provide heat to surrounding facilities and operate in combined heat and power (CHP) mode.

The spent steam leaving the steam turbines will be condensed and the resultant condensate returned to the boiler for reuse. Air cooled condensers will be used to cool and condense the steam for re-use in the boiler. The use of air cooled condensers means that there is no need for cooling towers or a once-through cooling water system, thereby eliminating the environmental impacts associated with such systems, which include a visible plume from a cooling tower and abstraction from, or discharge to, a local water course.

The plant may also provide heat to any neighbouring industrial plant(s) if it is technically and economically feasible. A CHP assessment has been undertaken for the project including consultations in accordance with the various groups suggested by the BERR in guidance note issued in December 2006. It would appear that there is some potential for the provision of hot water and steam to the neighbouring SABIC site to the west of the proposed plant. There is also potential for export of steam via steam pipelines which run adjacent to the site. Discussions are ongoing regarding both these opportunities which MGT are keen to pursue if practical.

The export of electricity from the power station will be via a new dedicated 400 kV underground cable to the existing Lakenby substation approximately 4 km to the south or via a local substation connected to National Grid's 400 kV line running past the west side of the site.

The flue gases from the plant will be discharged to a 95 m stack. The flue gas exit temperature of 95 °C and velocities above 25 m/s will typically be maintained to ensure adequate dispersion. Further details of the plants emissions are discussed in Section 6.

Lubricating oil or fire resistant oils will be supplied to the steam turbine and generator bearings and will also be supplied for the turbine control and hydraulic oil systems. The steam turbine system will comprise of a single steam turbine, condenser and condensate extraction pumps and air extraction facilities.

A recirculating closed circuit cooling water system will be used to cool the generators and lube oil coolers, with the closed circuit cooling water also air cooled. The cooling system will be designed to ensure that noise levels at nearby receptors are within acceptable limits as dictated by the Section 36 consent.

The steam turbine and boiler will be enclosed in an acoustically clad steel framed building to mitigate noise levels emanating from the site.

The boiler will be equipped with the proven pollution control technology, which will limit the production of oxides of nitrogen (NO_x) to a maximum of 150 mg/Nm^3. To ensure that the plant is able to meet this limit the combustion environment will be very turbulent, which avoids the formation of hot or cold spots. SNCR technology and long residence times will be used to reduce the NOx emissions further still. These techniques represent the Best Available Technique (BAT) for limiting emissions of NO_x to atmosphere from CFB boilers of the size proposed. The emissions of NO_x will be in accordance with the limits set in the Large Combustion Plant Directive (LCPD).

In addition to the heavy duty cyclones noted above, a separate fabric (bag) filter will be used to reduce the particulate concentration to 20 mg/Nm^3. Calcium oxide (CaO) may also be injected into the combustion gases to minimize halides and sulphur concentration should this be required though this is considered to be unlikely.

Storage for oils and chemicals will be provided in appropriately bunded and secure areas.

4.4.1 Civil engineering

The REP will be based on pile foundations supporting a reinforced concrete plinth. Pile foundations ensure the required structural stability and prevention of damage by ground settlement which is expected to occur given the geological make-up and coastal nature of the site.

Pile foundations will support the structures such as the boiler house, turbine, administration building, fuel store area and fuel storage tanks (which will also be supported on reinforced concrete ring beams).

Foundations for rotating or vibrating equipment will be designed in accordance with specified conditions to ensure that there will be no settlement of the units that could affect their operation; that vibration from the foundations will not adversely affect other nearby structures; and that there will be no resonance between the driving frequencies and the natural frequencies.

4.4.2 Superstructure

Construction of the super structure will comprise the erection of the steel building frames, CFB boiler, construction of the lower level walls and cladding of the upper level walls (including window installation) and roofs.

Internal structures and fixings such as flooring, walls, stairs, wiring, communication links and plumbing will be installed when weather proofing of the buildings are completed.

The fuel store area super-structure will include screw extractors, belt conveyors and a stacker/ reclaimer.

4.4.3 Water demineralization plant

The CFB boiler water/steam circuit will require high purity water to avoid internal corrosion and ensure optimal efficiency. The high purity water will be supplied by a water demineralization plant and will be stored in a demineralized water storage tank located adjacent to the boiler house.

Demineralized water quality in the CFB boiler water/steam circuit is also controlled by continuously purging or 'blowing down' small quantities of the demineralized steam/water from the system. This blow-down will also be replaced with demineralized water from the water demineralization plant.

The water demineralization plant is expected to treat towns water (ie drinking water) supplied by the local water company, using ion exchange to produce high quality demineralized water, and is expected to comprise two independent lines, each consisting of a towns water break tank, activated carbon filter, anion, cation, and mixed bed units.

Periodically, the ion exchange beds will require regeneration, where the anions and cations removed from the towns water and held by the resins are displaced with hydrogen and hydroxide ions from an acid and sodium hydroxide respectively. The acid used will comprise either hydrochloric or sulphuric acid. A maximum recycle time of 12 hours between regeneration is expected. Each of the two lines will be able to produce about 28.5 t/day of demineralized water, resulting in approximately 3 t/day of effluent produced per line.

A demineralized water storage tank will be located adjacent to the boiler house. This tank will be around 11 m high and 11 m diameter, and capable of storing around 720 m^3 of demineralized water, (ie sufficient for one day's operation).

4.4.4 Other items of plant

A small distillate oil fuelled auxiliary boiler of up to 3.2 MW will be installed to provide steam to enable a rapid start-up of the steam turbine. The boiler will have a small stack of the order of 15 m high. Given the small size and infrequent use of the auxiliary boiler, its emissions to atmosphere are considered negligible.

The auxiliary boiler provides steam, normally provided by the CFB, for deaeration of the feed-water/condensate before its introduction into the CFB; warms the steam piping and steam turbine gland system, establishes condenser vacuum during start-up of the main plant and provides steam for turbine sealing. The boiler therefore operates intermittently, typically for a few hours at a time, when the CFB low pressure steam is unavailable.

A small diesel powered generator will be provided to enable safe shutdown of the plant and provide electricity for critical motors in the event of total loss of electrical supply to the site. The standby generator will be tested for a short duration (of the order of a few minutes) on a routine basis, around once every week, to ensure that the standby generator remains available for use. Given the small size and infrequent use of the standby generator, its emissions to atmosphere are considered negligible.

Transformers will be provided for plant electrical supplies. All transformers will be oil filled and each transformer will be provided with a containment bund that will contain all the transformer oil in the event of a spillage. Pumps will drain these sumps to an oil separator which in turn will discharge to the site drainage system. The sumps will be installed with high level alarms to avoid overflow.

The remainder of the plant will consist of air compressing equipment, electrical switchgear and control equipment. Control facilities will be provided, as well as fire fighting services.

The compressed air system will be provided to compress and deliver air of a quantity and quality suitable for all general, instrument and control purposes at all appropriate points in the plant.

Process parameters will be continuously recorded to ensure correct and efficient operation of the plant. Any significant deviations will be alarmed and corrections carried out on occurrence. Records will be maintained of performance and deviation.

The plant will be designed with a view to automatic operation with a minimum of operator intervention being necessary. Full facilities for interfacing information, control and alarm systems will be installed so that the plant can be operated from the central control room via the distributed control system (DCS). In the event of a boiler trip the plant will shut down in a controlled manner.

The design of buildings, enclosures and plant will also minimize regular and long term maintenance. Sufficient spares will be held on site to ensure reliable operation of the plant. Materials and finishes will be selected to meet this objective and to ensure that the appearance of the plant does not deteriorate with time.

Major plant maintenance shut downs will be planned on a long-term basis with intermediate stoppages being infrequent and of short duration only.

Fire water may be stored in the lower half of the raw water tank. Both shared raw water tank for fire water usage and a fire water storage tank (if so installed) will be designed to comply with the relevant fire regulations and will be installed together with fire pumps, hose reels, fire hydrants and portable extinguishers. Fire systems are discussed further in Section 4.5.

4.4.5 Plant layout

The proposed Tees REP layout has been designed taking the following factors into consideration:

- access to the river frontage
- avoidance as far as possible of impact on the River Tees
- road access;
- connection to transmission network;
- provisions to minimize noise and visual impact;
- compliance with regulatory requirements;

- plant and personnel safety, particularly with respect to neighbouring tanks and pipework; and
- technical requirements.

A possible layout of the plant is shown in Figure 4.3. The layout will be subject to some changes as the design process is completed.

The power station buildings including the buildings housing the boiler and steam turbine plant will be located on the western side of the site, with a north -south orientation. The stack will be 95 m high and located on the northern side of the plant facing the River Tees.

The ACC will be located close to the steam turbines on southern side of the new plant to allow for an appropriate air flow to the condenser intakes.

New on-site roads and paved areas will be provided as required. Access will be via the existing access road to the wider Teesport site.

Water and DFO storage tanks will be located in the north western area of the site with the DFO tanks contained within a concrete bund sized to capture at least 110 per cent of the tanks contents.

The export of electricity from the power station will be via a new dedicated 400 kV underground cable to the existing Lakenby substation approximately 4 km to the south or via a local substation connected to National Grid's 400 kV line running past the west side of the site.

An administration building will be the official reception point of the operational REP and is located to the south of the main power station buildings. Comprising of a three storey, pitched roof building, around 45 m by 12 m in plan and 12 m in height, it will house a control room and office accommodation as well as other auxiliary systems such as workshops and stores.

The control room will house the REP's supervisory control and data acquisition (SCADA) system and will control and monitor the operation of the REP. The office accommodation will include work stations and offices for operational staff, reception area, meeting rooms, canteen, rest rooms, shower rooms, lavatories and storage rooms, as would be expected in a conventional office building.

A steel palisade fence will be constructed around the site for security reasons and the site will be fitted with closed circuit television.

Additional car parking space for maintenance periods will be provided on the southern side of the plant on land adjacent to the administration building.

4.4.6 Plant dimensions

The indicative dimensions of the main items of plant will be of the order of the following:-

TABLE 4.1
PLANT DIMENSIONS (m)

Building or external plant item	Length	Width	Height
Turbine house	57	25	35
Electrical control room	25	15	21
CFB boiler house	45	45	55
Fabric filters	26	40	25
Air cooled condenser	75	65	40
Fin fan cooler	45	23	6
Substation	20	20	5
Demineralization water building	16	15	8
Air compressor building	8	15	5
Fire fighting pump building	14	8	5
Workshop and store building	40	20	12
Office administration building	7	23	5
Covered fuel store 1	284	65	20
Covered fuel store 2 and 3	235	65	20

Building or external plant item	Height	Diameter
CFB exhaust stack	95	5.1
Fly ash silos	20	12
Bottom ash silos	20	18
Demineralized water storage tank	11	11
Fire fighting water storage tank	19	18
Low sulphur distillate fuel oil storage tanks	4	6

4.4.7 Fuel

The REP will be fuelled by around 2 400 000 tonnes of clean wood-chip fuel per year, delivered predominantly by sea transport perhaps with smaller domestic biomass being delivered by road or rail from MGT's certified sustainable forestry operations.

The majority of the fuel for the plant will be sourced from outside the UK, and delivered directly to the REP via the quay. Each ship will deliver around 40 000 tonnes of fuel (equating to around 60 deliveries per year) and will be docked at the deep water quay for three days to facilitate the fuel offloading operations. The fuel will be offloaded from the ship and transferred via a new belt conveyor system to a mobile discharger/reclaimer that enables the rapid forming of fuel stockpiles.

It is MGT's hope that a market will emerge for locally farmed energy crop biomass as a result of the construction of the plant. MGT anticipates that locally farmed energy crop biomass may ultimately provide of the order of 200 000 tonnes per annum. This will be brought to site by road. This would be delivered in 30 tonne HGVs and would result in up to 18 deliveries per day and in any case will not exceed a level deemed appropriate for the local road infrastructure.

The Tees REP site is serviced by the adjacent rail headings owned by PD Teesport. MGT is currently investigating the practicalities of delivering approximately 400 000 tonnes per annum by rail.

At any one time up to 120 000 tonne wood chip fuel will be stored on the plant's on-site store area to be located to east of the REP as shown in Figure 4.3. The fuel store will be covered, with a reinforced concrete base incorporating a rainwater drainage system, feeding to sumps.

A mobile fuel discharger/reclaimer will disperse the fuel into stockpiles of up to 15 m high within the fuel store area. This will allow the rapid construction of stockpiles and the automated recovery of these piles to feed into the CFB boiler. Fuel will be continuously reclaimed and returned to stockpile so that this rotation allows for the release of moisture and heat, preventing self heating. The fuel reclaimer will be backed-up by two small underground receiving hoppers located in the centre of the fuel storage area. When in use these hoppers will be continuously filled with fuel by tippers/bulldozers. At the base of each hopper will be screw extractors which continuously feed mixed wood chip into the CFB boiler.

Accurate and consistent fuel blending will contribute to the stable combustion performance, process efficiency and low atmospheric emissions from the REP. All overseas ship loading operations will issue an independent chemical analysis certificate which will arrive at the REP prior to the associated vessel. This will facilitate the forward planning of where the load from a particular ship should be distributed within the overall fuel store area, so that the store operators can recover a given blend of fuel from any point in the store.

The fuel store area will have a dedicated pressurized fire fighting ring and sprinkler system fed from the raw water tank. A reserved volume of the tank will always be available to the fire fighting system, and this will be backed up by extraction of water from Tees dock in an emergency. The final design of the fire protection systems will be undertaken in consultation with Cleveland Emergency Planning Unit.

There will usually be between 60 000 and 120 000 tonnes of fuel stored within the fuel storage area. This will provide sufficient fuel for continuous operation of the REP for between 8 and 16 days.

The fuel storage area's surface water drainage system will feed to sumps and will pass through an oil interceptor prior to discharge to a dedicated surface water holding tank. Section 4.4.8 below describes the fuel store area's surface water drainage system in more detail.

In the event of a fire, the surface water holding tank will receive spent fire fighting water and will be emptied by road tanker with the water disposed of at an appropriately licensed facility. This is discussed in more detail in Section 6.

There are times during commissioning, and periodically during operation, when the CFB boilers need to start (after being shut-down). Low sulphur distillate fuel oil (DFO) or biodiesel or a virgin vegetable oil will be used at these times to quickly bring the CFB combustion chamber temperature to the correct operating range prior to injecting wood chip. This same fuel will also be used in the auxiliary boiler and the onsite standby-generator when required. The sulphur content of the DFO will have a sulphur content of less than 0.1 per cent in accordance with European Community (EC) Directive 1999/32/EC.

Around 500 m^3 per year of low sulphur distillate fuel oil will be used, and will be stored on site within a 100 m^3 capacity bunded tank (around 4 m high and 6 m in diameter). Distillate fuel oil will be delivered to the REP via conventional road tanker of around 36 m^3 capacity (equating to around 28 deliveries per year) or where possible delivered to quayside in normal marine fuelling vessels. The storage tank will have level gauges visible from its filling point and an impermeable bund of 110 per cent of the tanks capacity to contain leakage. The bund will be monitored routinely and hydraulically tested on a regular basis. Any rain water or oil within the bund will be removed by a tanker for disposal at an appropriately licensed facility.

The fuel oil will have a lower calorific value of approximately 42 000 kJ/kg. This quantity of distillate fuel oil will not require the site to be registered as a COMAH site under the Control of Major Accident Hazards Regulations, 1999, (amended 2005), as the storage tanks will store less than the 2500 tonnes that the COMAH Regulations identify as the lower threshold for registration as a COMAH site.

The fuel supply contracts will also specify the analysis of the fuel. Intermittent analyses will be carried out to confirm that the fuels conform to the purchase specification. The sulphur content of the distillate fuel oil will be a maximum of 0.1 per cent and more typically 0.05 per cent.

4.4.8 Storage

In addition to the storage for the wood chip fuel and the DFO start up fuel the plant will also store a number of other materials.

Lubricating oils will be stored on the site within steel tanks in an impermeable bund sized to contain 110 per cent of the contents of each tank. The oils are used to lubricate the steam turbines. Used lubricating oils will also be stored on the site for re-use or will be disposed of off-site by an approved and licensed contractor in accordance with applicable regulations.

Storage facilities will also be provided for the small quantities of trisodium phosphate, hydrazine (or similar), ammonia and other chemicals used in boiler water dosing. All such chemicals will be retained in suitable containment areas. The boiler dosing chemicals and dosing systems will be shielded from the atmosphere. Air discharged from the ammonia and oxygen scavenger dosing and dilution tanks will pass through a final scrubbing device such as a common water seal and an active carbon filter.

Small amounts of flue-gas NO_x treatment reagent will be delivered to site via road vehicle. Dependent on the nature and packaging of these treatment agents, either conventional road tankers or vans/lorries will be used for its delivery.

Miscellaneous materials such as oils, greases, cleaning substances and materials, laboratory chemicals etc, will be stored in suitable storage conditions or containers on site.

All storage facilities will be designed, situated and used in compliance with Control of Substances Hazardous to Health (COSHH) regulations.

4.4.9 Drainage

Process and surface water drainage will remain separate to maximize the potential for the application of a Sustainable Urban Drainage System (SUDS) within the development. Surface water drainage is dependent on rainfall.

Process water drainage from the REP will comprise of boiler blow-down, water treatment plant effluent, sanitary and other minor discharges. This process water will discharge to a dedicated process water holding tank of around 5 m^3 capacity located adjacent to the boiler house where the process water will be cooled, solids settled and pH neutralized, prior to discharge to sewer.

Surface water drainage from the REP (from areas with a potential for contamination) will pass through an oil interceptor prior to discharge to a dedicated surface water holding tank of around 200 m^3 capacity located adjacent to the boiler house. From the surface water holding tank, the surface water will either discharge to the surrounding ground at a rate of approximately 50 litres/s through a dedicated SUDS network, or will be discharged at a rate of around 180 litre/s to the adjacent Teesport Docks. MGT will carry out an assessment of the potential application of a SUDS at the Renewable Energy Power Plant and will agree with the local authority and Environment Agency its feasibility and design, prior to construction.

No process water will be generated from the fuel store area. Surface water from the fuel store area will be collected in sumps, and will pass through an oil interceptor and suspended solids filter prior to discharge to a dedicated surface water holding tank of around 200 m^3 capacity located underground adjacent to the fuel store area. The sumps will be monitored for any contamination. From the surface water holding tank, the surface water will either discharge to the surrounding ground at a rate of around 10 litre/s through a dedicated SUDS network, or will be discharged at a rate of around 100 litre/s to the adjacent Teesport Docks. Surface water from the holding tank may also be used periodically to dampen the fuel within the fuel store area to minimize the potential for wind blown particles. MGT will carry out an assessment of the potential application of a SUDS at the fuel store area and will agree with the local authority and Environment Agency its feasibility and design, prior to construction.

Both surface water holding tanks and their associated discharge mechanism will be designed to ensure reasonable capacity remains within the tanks at all time to accommodate fire fighting water drainage (see further discussion in Section 6).

The Tees REP will generate around 20 m^3 per day of foul water drainage from washrooms etc which will be discharged either to the local sewerage system, or discharged to a package effluent treatment plant. MGT will agree the final solution with the local authority and Environment Agency.

4.4.10 Wastes

The main source of waste generated from the REP is ash from the fuel combustion process. The ash takes two forms, 'bottom ash' which is extracted from the main CFB combustion chamber and 'fly ash' which is extracted from the exhaust gas stream via the fabric filter.

Both fly ash and bottom ash are removed from the boiler house and transported by suitable closed conveyor to dedicated ash storage silos located adjacent to the boiler house. Up to 75 000 tonnes per year are produced and will be stored in separate dedicated storage silos, providing around 20 days ash storage capacity.

Wood ash is not contaminated or hazardous and both the bottom ash and fly ash will be sold for use in the cement, aggregates and fertilizer industries.

Other solid wastes generated from the Renewable Energy Project are minimal and are generally restricted to the following:

- Used ion exchange resins (typically replaced at 5 year intervals);
- Separated oil/sludge from oil/water separators;
- Used chemical storage containers;
- Foul water septic tank/septic tank/package effluent treatment plant sludge;
- General maintenance waste, including batteries; and
- General office waste.

These wastes will be returned to the original supplier or removed by a licensed contractor for recycling or treatment and disposal at a licensed waste management facility.

4.5 Safety and emergency plans

4.5.1 Construction

MGT will comply with all UK statutory regulations including in particular, the Health and Safety at Work Act, the CDM Regulations and the Electricity at Work Regulations and any other standards and Code of Practice relevant to the plant.

A Construction Site Safety Plan will be prepared by independent safety specialists to regulate on-site activities and achieve the highest level of safety and continuous improvement. Regular training and safety inspections will also be carried out by independent safety specialists.

Fundamental to the Construction Site Safety Plan will be the preparation of full Health and Safety Risk assessments for key activities to be undertaken during construction and commissioning of the REP, followed by development of risk minimization measures and then training of staff.

The requirements of the Construction (Design & Management) [CDM] Regulations 2007 will be fully complied with. These Regulations came into effect in 2007 under the Health and Safety at Work Act 1975 and were introduced to make major improvements in the communication of health and safety aspects of projects at all stages in the project lifecycle from inception to demolition.

The CDM Regulations establish a number of specific roles and a number of mandatory documents for all projects that come under the CDM regulations. The primary duty holders and a brief description of their obligations under the CDM regulations are outlined below:

- Client: the sponsor of the project or the client's representative in this;
- Planning Supervisor: to ensure the interaction of designers and constructors and to ensure that the primary documents are prepared, maintained and stored under the CDM regulations;
- Designer: the designer(s) of the project, whose design will be used in the project's construction;
- The Principal Contractor: the builder of the project and with specific CDM responsibilities with regard to contractors or subcontractors;
- Contractors: act as subcontractors to the main contractor in the construction of the project, or as under the CDM regulations as contractors under the principal contractor; and
- Enforcing authority: appropriate body that ensures that the requirements of the regulations are being adhered to and with significant legal and enforcement powers.

In addition to the named duty holders, there are standard documents defined within the CDM Regulations to ensure the transmission of health and safety information to all parties to the contract and the project. These comprise the designers' risk assessment, the pre-tender health and safety plan, the developed (or construction phase) health and safety plan and the health and safety file. These documents (in order of their production) address the following issues:

- Designer's risk assessment is an assessment of all the perceived hazards that are considered likely to arise in a project, with a measure of severity and consequences. These hazards are then reduced or removed through the design process and a list of residual risks is established that can be mitigated further through operational procedures, safe systems of work or training, to an acceptable level;

- The pre-tender health and safety plan removes those risks that a 'competent contractor' would be aware of (ie such as falls from height) and provides an overall risk profile and description of the project hazards;

- This is then developed further by the principal contractor and includes method statements, safety sheets (for the use of materials), programmes (dates and durations) and resource schedules (numbers of personnel);

- On completion of the construction works, the health and safety file is put together to contain as-built information and residual risk information for the operation, maintenance or cleaning of the building/facility. This document is kept as the permanent record by the client and is updated as aspects of the site are modified or expanded.

Through the above activities, levels of responsibility and prescribed documents the CDM Regulations lead to the safer design, construction and use of complex multi-disciplinary installations such as the REP.

A Permit to Work system will be introduced during construction to ensure that only authorized construction personnel are on site and that an accurate record of site based personnel is available in case of emergency.

The construction site will be secured from unauthorized entry by a combination of the early construction of sections of the permanent palisade security fence and temporary construction site security fencing.

Visitors to the REP during construction will be required to report to the construction site reception office and will only be permitted to access the construction area under escort by appropriately authorized staff or following successful completion of site specific safety training.

4.5.2 Operation

The hazards associated with power stations have been studied over many years and a considerable volume of design and procedural experience has built up in this area.

The design of the project will incorporate all the features needed to comply with relevant safety regulations. Both the Health and Safety Executive (HSE) and Cleveland Emergency Planning Unit have been and will continue to be consulted with regard to safety issues associated with the plant.

The storage of large quantities of woodchip fuel for a long period of time can become a potential fire hazard. This will be avoided via a combination of measures including:

- minimizing the storage time at Teesport. The wood yard is designed for a maximum storage time of 30 days and an average storage of 15 days;

- careful selection of wood chip feedstock at the overseas loading ports with respect to particle size, moisture content, and composition (ie those characteristics that determine inherent self heating propensity);

- monitoring of wood chip pile temperature during its journey to Teesport. International maritime regulations forbid the loading of hot material onto ship, reducing the probability that hot material will be discharged;

- Use of thermocouples and infra red monitoring cameras within the stockpile at Teesport;

- Preferential use of those areas of the stockpile that are older or warmer;

- Automated continuous rotation of areas of the stockpile to release built up heat and moisture and thereby reduce temperatures; and

- Fire detection and protection systems will be provided throughout the plant and site area. These will include fixed water protection systems, fire alarms, portable appliances, etc. Non-combustible and fire resistant building materials will be utilized where practical.

The protection systems will be specified in accordance with UK standards and will include triggers such as manual alarms and automated heat and smoke detectors. The fire protection systems will be installed to cover all equipment on site that could constitute a fire risk. The plant will employ conventional protective features, including emergency relief valves, shut down sequence interlocks, safety interlocks, fail safes, detection and alarm systems, mechanical and electrical protective devices. There will be back up systems and protective measures to deal with emergency situations such as electrical power failure, water supply failure, compressed air failure, major equipment failure and lightning strikes. Heat sensors will be used in conjunction with automatic spray nozzles and smoke detectors.

The Renewable Energy Plant (including the fuel store area) will have a dedicated pressurized fire-fighting ring and sprinkler system fed from the raw water tank, where a reserved volume around 3000 m^3 is available for this use only. The Teesport Docks lies immediately adjacent to the REP should additional fire-fighting water be required.

In sensitive operational areas (such as circuit breakers area, generating set, compressors area etc) where water spray will cause damage, a total flood carbon dioxide system will be used.

During a fire incident, each surface water holding tank will be isolated to retain the spent fire-fighting water, thereby preventing potential contamination of the surrounding area through spent fire water run-off. Spent fire water will subsequently be emptied from the surface water holding tanks by road tanker and disposed of at an appropriately licensed facility.

The fire fighting system will be tested periodically to ensure its continued availability.

Distillate fuel oil and chemical storage tanks will also be bunded to accommodate 110 per cent of the capacity of each tank, thereby preventing the dispersion of potentially flammable solutions. Following a fire event, any liquids contained within the tank bunds will be removed from site by road tanker for off-site treatment and disposal.

The fire fighting system will have two independent pumps, each one 100 per cent capacity (about 730 m^3/h capacity and around 130 kW power), the first is electrically fed and the second is driven by a diesel motor (as described above). A jockey pump is available to maintain the pressure in the pressurized ring to about 9 bar.

The proposed plant is in close proximity to the Teesside Linklines pipeline corridor which links several of the chemical sites on the Wilton International Complex to sites on Seal Sands, North Tees and the Billingham Complex. Pipelines in the corridor contain a variety of chemicals, gases and utilities and consideration has been given to any potential effects on the pipeline corridor from a major fire or incident upon the proposed development. Hence MGT has located the onsite wood chip stockpile as far away from this pipeline as possible.

Access to the site will be strictly controlled. Site security will be achieved by providing suitable fencing to the site perimeter and cameras.

An oil spill, chemical spill, or small localized wood chip overheating incident are recognized as being the principal environmental emergencies that could arise at the station. Emergency response plans will be developed in consultation with Redcar & Cleveland Council, HSE, and Cleveland Emergency Planning Unit to cover these events.

There are no installations involving the storage or handling of hazardous substances or installations licensed or permitted under pollution prevention control legislation that will be at risk from the proposed development.

In addition there will be no emergency situations at Teesport plant that could compromise the safety of the public in the vicinity of the site.

4.5.3 Occupational risk from neighbouring COMAH sites

The proposed Tees REP falls within the Consultation Distance and Public Information Zones of several chemical sites located on the north bank of the River Tees on the Seal Sands and North Tees complexes. The COMAH regulations apply to these sites and therefore an on-off site emergency plan will be developed for the plant that would take these sites into consideration. Consideration will include site evacuation procedures and the installation of toxic refuges for the safety and wellbeing of staff on the Tees REP. The on-off site emergency plan will be developed in consultation with Redcar and Cleveland Council, HSE, and the Cleveland Emergency Planning Unit.

4.6 Environmental monitoring and mitigation

In order to ensure that environmental considerations are addressed, construction activities will be carried out in accordance with:

- The mitigation measures proposed within the Environmental Statement
- Any consent requirements placed on MGT; and

- All relevant statutory requirements and published guidelines, and reflect 'best practice', such as the Construction Industry Research and Information Association's (CIRIA) guidance.

To facilitate this, a Construction Environmental Management Plan (CEMP) will be prepared by the construction contractor which will identify the potential environmental risks and impacts of key construction activities and the associated mitigation measures and actions to be adopted to prevent or minimize these risks and impacts.

The CEMP will be presented to the local authority prior to any works on site, and will provide clear guidance on good working practices on site in order to minimize impacts on the soil, geology, hydrology and hydrogeology, ecology, noise etc. A proposed audit and monitoring schedule will be included within the CEMP.

All construction personnel will be obliged to comply with the CEMP and will be trained in relevant environmental management techniques. A site representative will be responsible for the environmental management of the site and the adherence of construction personnel with the CEMP.

Where applicable, the CEMP would follow the requirements of ISO 14001 – 'Environmental Management Systems – Specification and Guidance For Use', and will include the following:

- Details of main contractor's corporate environmental policy;
- Assessment of environmental impacts during construction;
- Procedures and controls for environmental management;
- Environmental monitoring details and reporting systems;
- Schedule of contractual and legislative requirements; and
- Schedule of relevant consents, licences and authorizations.

Particular environmental impacts and associated mitigation measures that require to be addressed within the CEMP are discussed in relevant sections of this Environmental Statement.

For short periods of time during commissioning, emissions to atmosphere from the CFB stack will occur, dependant on the commissioning activity being undertaken. This is unavoidable and will be minimized wherever practicable. The continuous emission monitoring equipment within the stack will monitor atmospheric emissions in order to provide operators with information on the progress of the commissioning activities and to monitor combustion performance.

A remote continuous ambient air quality monitoring station will also be installed at a location agreed with the Environment Agency and the local authority at least one year prior to commissioning of the CFB boilers. Ambient air quality data will be provided to the local authority and Environment Agency on an annual basis, or as otherwise agreed in advance.

Periodic environmental audits will be carried out in line with the CEMP to identify areas for improvement in the environmental management of the construction site.

The monitoring and mitigation recommended by this ES in summarized in Section 15 for clarity.

4.7 Personnel

Numbers of construction personnel on-site are expected to peak at around 600, with average personnel numbers around 400.

A significant portion of construction personnel will be sourced form the local area, and local contractors will be encouraged to tender for construction works packages. In support of this, MGT has launched a web-based register for interested companies and individuals at www.mgtteesside.com. MGT will host seminars for local businesses to assist in the identification of supply and support opportunities during the construction of the REP.

Personnel at all levels will receive training (appropriate to their job function) related to environmental management and health and safety.

Approximately 150 personnel would be required for the operation of the proposed plant.

4.8 Construction

The construction contractor will be required to prepare and implement a Construction Environmental Management Plan (CEMP). This Plan will identify the mitigating measures and management procedures that will be put in place to adequately control the environmental impacts of the construction stage, incorporating the relevant sections in this document and the application for a EPA Permit. A waste management plan will also be developed.

4.8.1 Site preparation

Studies examining soil composition and contamination will be undertaken by the construction contractors, using the results of site investigations carried out during the development phase of the project as a starting point. An application site report will be undertaken as part of the EPR Permit application to the Environment Agency.

Initial construction works will comprise of site clearance, removal or remediation of any existing contamination present within the site.

In parallel with the site clearance, a temporary construction compound will be located within the fuel storage area. This laydown area, constructed of compacted reinforced hardcore and draining to a dedicated surface water storage tank, will be used to house temporary construction site offices (including canteen, lavatory and first aid facilities), material and equipment storage, fuel storage and car parking, and may also be used for component fabrication works. This area will be converted to the fuel storage area during plant commissioning.

Excavations will be required to construct foundations, culverts, buried services and basement structures. Excavation activities create the potential risk of disturbing and hence releasing contaminants into the surrounding environment. In addition it will be necessary to undertake piling for the foundations where the heavier plant equipment will be located.

The major activities during the construction phase of the project include, for the civil works:

- preparation of site works
- construction of foundations
- construction of buildings.

An archaeological consultant will be invited to the site to inspect any excavations made should anything of interest be found.

It is likely that piling will be required for the boiler, steam turbine(s), and generator foundations due to the heavy loading and the tight tolerance on settlement. The remaining foundations will either use piled or spread footings and slabs of various thicknesses to suit the structural needs.

The programme for the mechanical and electrical plant can be considered in terms of the following activities:

- boiler manufacture
- steam turbine manufacture
- power plant erection
- power plant commissioning
- plant take-over
- power plant commercial operation
- guarantee period.

Figure 4.4 shows the proposed construction programme. The construction period will be of 34 months duration, including commissioning.

Construction work will only take place during daylight hours and will be limited to the following:

Monday to Friday	07:00 – 19:00 hours
Saturday	07:00 – 13:00 hours

with no work on any Sunday or Bank Holidays, unless such work is associated with an emergency or does not cause existing ambient noise levels to be exceeded.

Should a need arise, due to technical constraints or similar, with regard to carrying out certain construction work outside the time indicated above, prior written approval from the Local Authority will be sought.

Commissioning the plant will take of the order of 16 weeks and will be progressive from final erection checks, pre-commissioning and setting to work of individual component parts through to the overall testing to prove the technical acceptance of the plant. Tests on completion will demonstrate the fitness for purpose of the plant prior to commercial operation. Performance tests will demonstrate that the plant complies with the performance guarantees. Reliability will be demonstrated by operating the plant under commercial conditions for a period without major repair to any item of plant or equipment.

Where practicable, wastes generated during construction will be recycled. All construction surplus and waste materials will be stored in dedicated areas and will be regularly removed to a licensed waste management site by an appropriately licensed waste carrier.

MGT will convene a weekly site liaison committee to communicate planned activities over the following week, month and calendar quarter. The aim of this meeting will be to ensure that all construction activities are well communicated and understood by all parties on site.

Construction of the new plant is expected to commence in 2009. The construction workforce will peak at about 600 with in the order of 60 per cent of these expected to be from the surrounding area. The target date for full operation is summer 2012.

4.9 Decommissioning

At the end of the useful life of the power station, in approximately 25 years, the plant will be decommissioned in accordance with legislative guidelines current at that time. Alternatively, if market conditions and/or electricity supply constraints at that time indicate that it would be appropriate to extend the life of the plant, then decommissioning may be deferred to a later date. In order to ensure continuing adequate plant conditions and environmental performance, the plant would be re-engineered and re-permitted as required, dependent of the legislative requirements at that time.

Independently validated plant closure/demolition methodologies have been developed for power plants that are at the end of their useful life. The methodology covers demolition of the plant and buildings and removal of any contaminated and hazardous material from the site. When demolishing the power plant, it will be a matter of policy to ensure that the site is left with no environmental risks.

Decommissioning will be in accordance with the requirement of the plants EPR Permit including the site closure plan included as part of the EPR Application.

In order to facilitate decommissioning much of the plant on site will be made of materials suitable for recycling. In addition a large proportion of the buildings will be constructed of pre-fabricated steel and will therefore also be of interest to a scrap metal merchant. After the removal of the main items of plant and steel buildings the remaining buildings will be demolished to ground level. All underground structures will either be removed or made safe. All debris to be removed offsite will be sent to a licensed disposal facility for recycling.

The decommissioning phase is likely to take place over several months.

The results of the pre-construction contaminated land survey will be used as a basis for a further contaminated land survey to be performed when the plant is closed to assess whether or not any contamination of the site has taken place during the lifetime of the plant. The site will be returned to a condition suitable for reuse.

A full environmental departure audit will be carried out. This will examine, in detail, all potential environmental risks existing at the site and make comprehensive recommendations for remedial action to remove such risks. Following completion of the demolition, a final audit will be carried out to ensure that all remedial work has been completed. The audit reports will be made available to future users of the site.

Prior to MGP closing down the plant the Environment Agency will be notified as to the date of the closure and the results of the departure audit submitted.

During decommissioning all reasonable measures required to prevent any future pollution of the site will be carried out. This will include measures such as:

- The emptying/cleaning and removal of storage tanks
- The removal from site of all materials/liquids liable to cause contamination.

The surface water drainage system for Teesport plant will continue to operate through the decommissioning phase. Any areas where oil spillage could occur will continue to drain to an oil interceptor, which will continue to be maintained.

The sites subsequent use would be discussed with the local authorities as part of the decommissioning process.

5. EIA METHODOLOGY

This ES has been prepared to document the findings of the EIA that has been undertaken to determine the potential extent of any environmental impacts (both beneficial and adverse) with regard to the development of the proposed Tees Renewable Energy Plant (Tees REP). Where adverse impacts have been identified, the ES goes on to identify potential mitigation measures to ensure that these impacts are reduced or remedied entirely. For impact that cannot be entirely remedied the ES identifies the residual effects once the mitigation is considered. Monitoring has been recommended in some cases to help demonstrate that the project is operating in compliance with the performance criteria identified in this ES.

5.1 Environmental Impact Assessment project team

The EIA has been undertaken by PB Power, Registered Environmental Impact Assessors with the Institute of Environmental Management and Assessment (IEMA), a leading international organization dedicated to the promotion of sustainable development and to the promotion of best practice standards in environmental assessment and management.

In undertaking the various EIA studies PB Power have been assisted by Pre-Construct Archaeology (PCA) who have undertaken archaeological investigations for the project.

5.2 Assessment of environmental impacts and their significance

The purpose of an EIA is to determine the environmental impact of a project, in this case a power station, is within acceptable limits. Additionally it serves to inform the project design to ensure that where ever possible environmental impacts are minimized.

In undertaking an EIA for any project it is important to identify the environmental baseline at the site being considered for development. This allows the impacts of the proposed project to be seen in the light of the existing environment and allows for better identification of the most appropriate mitigation that could be employed to minimize these impacts.

To help evaluate and quantify the impact of the project on the receiving environment, significance criteria can be employed to ensure that the impacts are within acceptable limits. Such criteria are developed to reflect the specific impact under consideration and where ever possible are based on recognized methodologies such as those identified by the Landscape Institute and the Institute for Environmental Management Assessment.

Each of the environmental impact assessment chapters contained within this ES has been broken down to include the following sections:

- **Introduction**, detailing the key issues with regard to the specific impact being considered.
- **Key Planning Policies**, which provides a summary of the planning policies contained within the relevant Development Plan that can be considered as being relevant to the project.

- **Assessment Methodology**, providing details of the assessment methodology adopted for the purposes of the EIA reflecting relevant guidelines and legislative standards. These sections also identify significance criteria used to quantify the extent of the environmental impact of the proposed plant where applicable.

- **Existing Environment,** identifies the existing environment that could potentially be impacted on by the proposed plant.

- **Potential Impacts,** discusses the findings of the environmental impact assessment studies. Potential impacts are identified as being considered to be direct or indirect, long, medium or short term and positive, neutral or negative. In undertaking this assessment a both quantitative and qualitative evaluations are necessary to varying degrees depending on the nature of the impact being assessed. Significance of the impacts identified are addressed as appropriate with reference to the significance criteria established for specific impacts.

- **Mitigating measures and monitoring programmes**, details the mitigation measures that have been identified to ensure that environmental impacts are either minimized or where possible avoided all together. Monitoring is in some cases identified to allow it to be demonstrated that the mitigation measures employed are effective.

5.3 Monitoring and mitigation philosophy

Full consideration has been given to potential mitigation techniques to ensure that the environmental impact of the project is minimized. The proposed plant will continue to be developed in such a way that reduction and where possible elimination of environmental impacts associated with the project are an integral component to the overall project design.

Where it is not possible to avoid environmental effects, for example where habitat will be permanently removed, plans have been prepared to help compensate for the impact identified such as additional habitat creation in a suitable location.

6. AIR QUALITY

6.1 Summary

This section of the Environmental Statement considers the impact of the proposed Tees Renewable Energy Plant (REP) on local air quality. A separate assessment of the impact of the proposed plant on air quality at sites afforded protection due to their ecology is presented in Section 13.

Neither Redcar and Cleveland Borough Council nor any of the districts which are in close proximity to the site (including Middlesbrough, Stockton on Tees or Hartlepool) have declared any Air Quality Management Areas (AQMAs). There are a number of automatic monitoring sites that are operated on behalf of the Department for Environment, Food & Rural Affairs (DEFRA) in the UK. The nearest monitoring station to the site is in Redcar on Corporation Road (NO_2, SO_2 and PM_{10}). This station shows that air quality is relatively good in the Teesside area.

The proposed plant will utilize woodchip supplied from sustainable forestry operations, which is naturally low in pollutants. The emissions of most interest from the new plant are those of NO_x and SO_2. A stack height determination study has been undertaken for both NO_2 and SO_2. A stack height of 95 m is considered to be an effective stack height for the satisfactory dispersion of all pollutant gases in order to result in ground level concentrations which are below recommended levels of significance.

A dispersion modelling exercise has been undertaken to predict the impacts of the proposed plant's operation quantifying the contributions the proposed biomass plant will make to the existing background ground level concentrations of NO_2 and SO_2 in order to determine the overall effect on local ambient air quality. The emissions of PM_{10}, CO and HCL during woodchip firing have also been assessed using dispersion modelling. The assessment of the impact on air quality due to emissions from the proposed biomass plant is based on the predicted changes of the ground level concentrations of pollutants in accordance with the UK Air Quality Strategy (AQS) and Environmental Assessment Levels (EAL), which have set standards and objectives for these ambient concentrations.

The dispersion modelling exercise also assessed the long term NO_2 impact of the proposed Tees REP operating in conjunction with the proposed Thor Cogeneration (Px) project (a Combined Heat and Power (CHP) combined cycle gas turbine (CCGT) facility) and the Teesside CHP (ConocoPhillips) plant. Both plants are situated in Teesside within the vicinity of the site.

The predicted concentrations are considered to represent a worst case as baseload operation is assumed, where as in reality the plant may actually run at various loading regimes. The effect of this on predicted concentrations of the various pollutant gases will be to reduce the long term average, as the plant is operating less, and also to potentially lower the maximum predicted short term averages, as the plant may not operate during the meteorological conditions leading to peak concentrations.

The results of the modelling have been compared to AQS objectives. Key findings from the analysis are:

- the predicted maximum long term NO_2 concentration when the proposed plant is operating in isolation is 0.2 $\mu g/m^3$, significantly below the long term AQS objective

of 40 μg/m^3. The maximum concentration occurs at a point 1.1 km north west of the site in the vicinity of the ConocoPhillips industrial complex on the opposing side of the River Tees and some 4 km from the residential receptors in Grangetown and Redcar.

- the maximum short term NO_2 concentration when the proposed plant is operating in isolation is 6.4 μg/m^3, representing only 3 per cent of the AQS objective of 200 μg/m^3. This maximum concentration occurs at a point 1.4 km north west of the site over the ConocoPhillips industrial complex.

- the predicted maximum hourly and 15 minute mean SO_2 concentrations are 23.9 μg/m^3 and 28.5 μg/m^3 respectively,. The maximum hourly concentration represents 7 per cent of the 350 μg/m^{3}objective, while the maximum 15 minute mean concentration represents 11 per cent of the 266 μg/m^3 objective. Both maximums occur less than 1 km north west of the site in the vicinity of the ConocoPhillips industrial complex.

- the predicted maximum 24 hourly SO_2 concentrations at any receptor when the proposed plant is operating in isolation is 13.3 μg/m^3, which represents 11 per cent of the 125 μg/m^{3}AQS objective. This maximum concentration occurs 1.1 km north west of the site in the vicinity of the ConocoPhillips industrial complex.

- the proposed plant will not generate any exceedances of the short term AQS objective for carbon monoxide or particulates with the predicted concentrations of these pollutants being negligible. Similarly the proposed plant will not generate any exceedances of the long term AQS objective for particulates or EAL for hydrogen chloride with the predicted concentrations of these pollutants again being negligible.

- there are no exceedences in the long term NO_2 objective when the plant is running in combination with the proposed Thor Cogeneration (Px) and Teesside CHP (ConocoPhillips) plant. Even in combination the 3 plants only just exceed 1 per cent of the AQS objective for annual NO_2.

- when combined with the existing ground level concentrations in the area it is not considered that there is any potential for the plant to give rise to exceedences of the long term NO_2 objective or indeed those for SO_2, PM_{10}'s, CO or HCl.

A water vapour plume visibility study has been undertaken to determine the frequency and length of any visible plumes resulting from the Tees REP. It is expected that the plume will be visible for no more than 1315 hours per a year (ie 17%), and most of this will be at night time. The average length of the visible plume during the year is expected to be no more than 110 m. Given the industrial setting of the site, and the low frequency of the visible plumes, plume visibility is considered to be of minor impact. Consideration has been given to using plume reheaters to remove the visible water vapour, but this has been rejected as being a significant waste of process heat with no environmental benefit other than a minor visual impact improvement.

In conclusion, the impact of the atmospheric emissions from the Tees REP will be well within the AQS and EAL objectives even when considered in conjunction with the proposed Thor Cogeneration (Px) and ConocoPhillips projects.

6.2 Introduction

This section presents the findings of the assessment of the air quality impact of the proposed Tees Renewable Energy Plant (Tees REP). Details of the assessment methodology and significant criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

Cumulative impacts of the plant and other developments in the vicinity are also considered.

6.3 Assessment methodology and significance criteria

6.3.1 Assessment methodology

The assessment of the impact on air quality is based on the predicted contributions to ground level concentrations of pollutants. This is a requirement of the Environment Act 1995 and the UK National Air Quality Strategy (NAQS), which have set standards and objectives for these ambient concentrations.

The United Kingdom Air Quality Strategy has specified a series of standards and objectives for air quality in the UK. These were most recently amended in January 2000 and are as follows:

Nitrogen dioxide:	hourly maximum of 200 $\mu g/m^3$ not to be exceeded more than 18 times a year (equivalent to the 99.79th percentile).
	provisional annual average of 40 $\mu g/m^3$
	annual average objective for the protection of vegetation of 30 $\mu g/m^3$
Sulphur dioxide:	15 minute mean guideline of 266 $\mu g/m^3$ not to be exceeded more than 35 times a year,
	1 hour mean of 350 $\mu g/m^3$ not to be exceeded more than 24 times a year (equivalent to the 99.73rd percentile).
	24 hour mean of 125 $\mu g/m^3$ not to be exceeded more than 3 times a year (equivalent to the 99.18th percentile).
	new annual and winter objective for the protection of ecosystems of 20 $\mu g/m^3$
Particulates (PM_{10}):	24 hour mean of 50 $\mu g/m^3$ not to be exceeded more than 35 times a year.
	annual average of 40 $\mu g/m^3$
Carbon monoxide:	running 8 hour mean of 10 000 $\mu g/m^3$.

There is no AQS for the only remaining pollutant of interest for the plant, HCl, however the Environment Agency's technical guidance note H1 defines both short and long term Environmental Assessment Levels (EAL) for this pollutant:

Hydrochloric Acid: 1 hour maximum of 800 µg/m^3 not to be exceeded.

annual average of 20 µg/m^3

The European Community has also set ambient air quality guidelines for nitrogen dioxide, sulphur dioxide and particulates (Directive 99/30/EC) adopted 22 April 1999. A summary of the Directive is set out below in Table 6.1 and Table 6.2. The guidelines include the same limit values and numbers of permitted exceedances as the UK AQS, however the deadlines for meeting the EC guidelines are generally later.

TABLE 6.1
EC AIR QUALITY STANDARDS
FOR THE PROTECTION OF HUMAN HEALTH

Parameter	Reference period	Compliance date	Statutory ground level concentration limit values (µg/m^3)	Number of permitted exceedances	Equivalent percentile
Nitrogen dioxide	Hourly	2010	200	18	99.79
	Annual	2010	40	-	-
Sulphur dioxide	Hourly	2005	350	24	99.73
	24 hourly	2005	125	3	99.18
Particulates (Stage 1)	24 hours (daily mean values)	2005	50	35	99.41
	Annual limit	2005	40	-	-
Particulates (Stage 2)	24 hours (daily mean values)	2010	50	7	99.9
	Annual limit	2010	20	-	-

TABLE 6.2
EC AIR QUALITY STANDARDS
FOR THE PROTECTION OF VEGETATION/ECOSYSTEMS

Parameter	Reference period	Statutory ground level concentration limit values
Nitrogen dioxide	Annual	30 µg/m^3
Sulphur dioxide	Annual	20µg/m^3

It is important to define the areas in which the limit values in Table 6.2 are to be achieved. The Directive states that sampling points should be:

- at least 5 km from major emission sources; or
- 20 km from an agglomeration, which is defined as an area with a population of more than 250,000; and
- representative of areas of at least 1,000 km^2.

The Government and devolved administrations require that these objectives will apply in those parts of the UK that are:

- more than 20 km from an agglomeration; and
- more than 5 km away from industrial sources regulated under Part A of the 1990 Environment Protection Act;
- more than 5 km from motorways; and
- built up areas of more than 5,000 people.

As the majority of the Teesside industrial area consists of Part A industrial installations the above limit is not applicable within the majority of the 10 km radius surrounding the proposed site. Nevertheless the limits have been applied in the habitats assessment included in Section 13.5.4.1.

The Environment Agency (EA) suggest in their Technical Guidance note H1 that results of modelling can be considered to be "significant" where they predict that the contribution from the plant exceed 10 per cent of the short term objectives/EAL (up to 24 hour averages) and 1 per cent of the long term objectives/EAL (monthly/annual results etc).

The EA significance thresholds will be applied for the purposes of the impact assessment though it is noted that the EA guidance does not distinguish between processes or the extent of the area of impact. Whilst these criteria will be referenced it is therefore very important that results are seen in a qualitative rather than a mere quantitative light.

6.4 Baseline conditions and receptors

This section discusses ambient air quality in the vicinity of the proposed plant drawing on information collected by Redcar and Cleveland Borough Council (the local authority), the Tees Valley Environmental Protection Group, the UK Automatic Air Quality Network and the National Air Quality Archive.

6.4.1 Local authority ambient air quality

Baseline conditions can also be determined by examining Local Authority ambient air quality data. Local authorities have duties under Part IV of the Environment Act 1995 to assess air quality. Full details of the duties are set out in the UK Air Quality Strategy. If pollutant levels are likely to exceed

statutory objectives, then they must declare an Air Quality Management Area (AQMA) and draft action plan to achieve the objectives. The Department of Environment Transport and the Regions (DETR) has issued technical guidance to the Local Authorities to assist in undertaking this task. The process comprises three stages:

- Stage 1 is intended to assist the authority in determining which existing and proposed sources may have a significant impact on air quality.
- Stage 2 is intended to provide additional screening of pollutant concentrations in the area and determine the risk of non-compliance with the air quality objective by the relevant future year.
- Stage 3 entails a detailed and accurate appraisal of the potential impacts of the outcome of Stages 1 and 2; the authority is required to determine both the magnitude and the geographical extent of any likely exceedences of the objectives.

At the end of the three stage process the Local Authority should have identified areas where there are likely exceedences of the objectives and for each pollutant calculate:

- how great an improvement is needed to meet the objectives
- the extent to which different sources contribute to the problem.

This gives the authorities a clear picture of the sources which can be controlled or influenced and aid the authority to target more effectively and ensure that the relative contributions of industry, transport and other sectors to the solution are cost effective and proportionate when producing their action plan.

As part of the ongoing review and assessment process a phased approach is adopted to ensure that the level of assessment is commensurate with the risk of an air quality objective being exceeded. Therefore each local authority is required to undertake an Updating and Screening Assessment (USA) in order to identify changes, which have occurred since the previous review and assessment, which could potentially lead to a risk of an air quality objective being exceeded. Where a risk has been identified the local authority is required to undertake a more detailed assessment to determine the likelihood of an exceedence and revise the AQMA as appropriate. The last USA undertaken in Redcar and Cleveland was in 2006.

Neither Redcar and Cleveland Borough Council nor any of the districts which are in close proximity to the site (including Middlesbrough, Stockton on Tees or Hartlepool) have declared any AQMAs as a result of their latest USA.

6.4.2 Tees Valley Environmental Protection Group

The Tees Valley Environmental Group have reported records of air quality results, since 2002, from all of the monitoring stations across the Tees Valley, and compares them with the thirteen regulated objectives and the four proposed objectives of the AQS.

The nearest monitoring station to the site is that at Redcar (grid reference NZ600246). There are also monitoring stations at Billingham (grid reference NZ470237), Middlesbrough (grid reference NZ505194) and Stockton (NZ41912).

The majority of results are from continuous monitoring stations, which are the most accurate. Four fixed continuous monitoring stations are part of the national Automatic Urban and Rural Network (AURN stations). The remaining eight fixed continuous monitoring stations are Local stations, results from which are held by the local authority.

TABLE 6.3
AURN STATIONS
NO_2 AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Stockton, Billingham (Cowpen Bewley)		Middlesbrough) (Breckon Hill		Redcar (Corporation Road)		Stockton (Yarm High Street)	
Year	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**
2002	135	30	84	26	80	22	120	38
2003	152	32	105	25	97	25	135	43
2004	145	29	74	23	76	22	109	36
2005	145	27	122	25	82	25	117	34
AQS	200	40	200	40	200	40	200	40

TABLE 6.4
LOCAL STATIONS
NO_2 AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Darlington (Cockerton Bridge)		Darlington (St Cuthberts Way)		Hartlepool (Stockton Road)		Hartlepool (Seaton Carew)		Middlesbrough (MacMillan College)		Middlesbrough Corporation Road)	
Year	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**
2002	-	-	95	35	-	-	63	16	93	25	93	32
2003	-	-	101	36	67	19	67	22	106	30	124	34
2004	84	23*	102	34*	66	20	-	-	85	23	78	26
2005	88	24	126	41*	101	18*	-	-	80	25	75	25
AQS	200	40	200	40	200	40	200	40	200	40	200	40

***- less than 6 months data. Data annualiZed using Stockton (Yarm) AURN station.**

TABLE 6.5
AURN STATIONS
SO_2 AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Middlesbrough (Breckon Hill)			Redcar (Corporation Road)		
Year	**Hourly**	**Daily**	**15 Minute mean**	**Hourly**	**Daily**	**15 Minute mean**
2002	88	21	128	82	35	112
2003	88	35	117	77	29	106
2004	66	19	92	80	32	119
2005	67	24	96	70	28	112
AQS	350	125	266	350	125	266

TABLE 6.6
LOCAL STATIONS
SO_2 AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Stockton, Billingham (Cowpen Bewley)			Hartlepool (Stockton Road)			Hartlepool (Seaton Carew		
Year	**Hourly**	**Daily**	**15 Minute mean**	**Hourly**	**Daily**	**15 Minute mean**	**Hourly**	**Daily**	**15 Minute mean**
2002	69	43	96	-	-	-	77	48	101
2003	61	21	80	35	21	53	-	-	-
2004	39	18	56	26	15	36	-	-	-
2005	40	18	53	24	14	30	-	-	-
AQS	350	125	266	350	125	266	350	125	266

TABLE 6.7
AURN STATIONS
PM_{10} AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Middlesbrough (Breckon Hill)		Redcar (Corporation Road)		Stockton (Yarm High Street)	
Year	**24 Hour mean**	**Annual**	**24 Hour mean**	**Annual**	**24 Hour mean**	**Annual**
2002	34	22	36	22	43	29
2003	51	27	43	27	57	32
2004	35	21	37	23	41	27
2005	43	27	38	24	40	26
AQS	50	40	50	40	50	40

TABLE 6.8
LOCAL STATIONS
PM_{10} AMBIENT AIR QUALITY RECORDS
($\mu g/m^3$)

	Stockton, Billingham (Cowpen Bewley)		Darlington (Cockerton Bridge)		Darlington (St Cuthberts Way)		Hartlepool (Stockton Road)		Hartlepool (Seaton Carew)		Middlesbrough (MacMillan College)		Middlesbrough Corporation Road)		Grangetown (Mannion Park)	
Year	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**	**Hourly**	**Annual**
2002	36	21	-	-	45	29	-	-	49	26	34	22	-	-	42	23
2003	45	24	-	-	56	32	38	21	-	30*	44	24	35	23*	43	27
2004	32	19	-	20*	49	31*	34	19	-	-	31	19	36	22	40	23
2005	32	19	31	20	49	31*	39	24*	-	-	32	20	36	23	37	25
AQS	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40

***-less than 6 months data. Data annualized using Stockton (Yarm) AURN Station**

6.4.3 National Air Quality Archive

The above results can be compared to the results predicted by the NETCEN air quality database. Table 6.9 gives detail of the maximum annual ground level concentrations estimated for the Borough including NO_2, and PM_{10} and projection for the year 2010.

TABLE 6.9
ANNUAL POLLUTANT LEVELS ESTIMATED
FOR REDCAR AND CLEVELAND BOROUGH COUNCIL
($\mu g/m^3$)

Pollutant	Year	Redcar and Cleveland Borough Council
NO_2	2004	16.8
	2005	16.3
	2010	14.3
PM_{10}	2004	17.2
	2005	17.1
	2010	16.0

The information presented in Table 6.3 to Table 6.8 above shows a general improvement in ambient air quality for pollutants measured. In no cases were the ambient ground level concentrations found to exceed the relevant AQS objectives at the nearest monitoring station situated on Corporation Road in Redcar (grid reference NZ600246). Table 6.9 also shows that future estimates for NO_2 and PM_{10} are unlikely to exceed the relevant AQS objectives.

6.5 Potential impacts

6.5.1 Construction

Dust could be emitted during several activities associated with the construction works should preventative measures not be taken. During dry summer months dust could arise from: earth moving operations for site levelling (that will be minimal), back filling and foundations; removal of spoil, site stripping, blow-off and spillage from vehicles; concreting operations, site reinstatement and road construction and during wind blow over bare dry construction areas.

Only with high wind speeds would long distance transport of dust and the potential for soiling of buildings occur. In these conditions more dust would also be created at source. The extent of any such emissions of dust is very dependent on wind speed, ground conditions, the prevalence of hot, dry conditions and the use of preventative measures.

The dust particles that may be emitted during construction would normally be of large diameter and would therefore tend to resettle on the ground within 100 to 500 m of the site. Approximately 70 per cent of the dust would generally settle out of the atmosphere within 200 m of the source, and less than 10 per cent could be expected to remain at a distance of 400 m. With the nearest housing being at a distance of 2.5 km and with roads lying between, soiling of residential buildings is unlikely to occur.

Dust emissions from the site will not be more onerous than those normally encountered on construction sites. Construction operations will be conducted so as to minimize the generation and spread of dust. MGT will require its contractors to implement a comprehensive mitigation and monitoring programme. This will prevent construction work generating levels of atmospheric dust which would constitute a health hazard or nuisance to people working on the site or working or living nearby the site.

As the mitigation measures outlined in Section 6.7 will be employed, dust is unlikely to result in any significant environmental impact during the construction phase.

The use of wheel and chassis washing units will also help to prevent the transport of mud and dust onto off-site routes.

The commissioning of the plant will take about 16 weeks. The purpose of commissioning is to adjust the performance of the newly installed plant to achieve all required operational and environmental performance criteria. Firing of the boiler will be intermittent during this period. It is possible that during commissioning the emissions of oxides of nitrogen will be temporarily higher than those during normal operation. However, operational periods during commissioning are often short and operation is frequently at low load. Thus the total mass emissions of oxides of nitrogen and other pollutants during commissioning will be low.

6.5.2 Operation

The Environment Agency in their Technical Guidance Note H1, Environmental Assessment and Appraisal of Best Available Techniques (BAT) provide guidance to allow for the determination of whether detailed assessment, via dispersion modelling, of various pollutants that will be emitted, as part of combustion process, is required.

The H1 assessment proscribes a high level calculation to determine the likely long and short term ground level concentrations that might arise from an installation based on release rate of the pollutant to be assessed and a dispersion factor derived from the plant stack height.

To determine the pollutants that should be considered as part of the more detailed dispersion modelling exercise, calculations have been undertaken using this guidance based on the stack height, and emissions rates and parameters shown in Table 6.14. The results of these calculations showed that the emissions of most interest from the new plant are those of NO_x. It should be noted however, that only a proportion of the NO_x released will be converted to the more harmful NO_2 pollutant. The principles behind the NO_x to NO_2 conversion is discussed in more detail in Section 6.5.4. Other pollutants found to be of interest include SO_2, PM_{10}, CO and HCL.

The contribution to ground level concentrations of these pollutants due to the new plant have been quantitatively assessed using dispersion modelling techniques and have been compared with the background air quality in the area and with EC legislation and UK guidelines.

Wood chip will be used as the generation fuel in the plant. It is an inherently clean fuel which results in much lower NO_x and SO_2 emissions when compared with fuels such as oil or coal.

6.5.3 Control of oxides of nitrogen during combustion

The formation of oxides of nitrogen in the combustion of fossil fuels is unavoidable. NO is the principal oxide of nitrogen produced, with a small proportion of NO_2. The ratio of NO_2 to NO is approximately 1:19.

The boiler will be equipped with proven pollution control technology, which will limit the production of oxides of nitrogen (NO_x) to a maximum of 150 mg/Nm^3. To ensure that the plant is able to meet this limit the combustion environment will be very turbulent, which avoids the formation of hot or cold spots. Selective non catalytic reduction (SNCR) technology will be used to reduce the NO_x emissions further still. These techniques represent the Best Available Technique (BAT) for limiting emissions of NO_x to atmosphere from circulating fluidized bed (CFB) boilers of the size proposed. The emissions of NO_x will be in accordance with the limits set in the Large Combustion Plant Directive (LCPD).

6.5.4 Conversion of nitric oxide to nitrogen dioxide

NO_x emissions from the proposed plant will consist of the gases NO and NO_2. It is only NO_2 that is of concern in terms of direct health and environmental effects. However NO is a source of NO_2 in the atmosphere. The gases are in equilibrium in the air, with NO predominating at the stack exit. As the plume cools, the equilibrium changes, resulting in a predominance of NO_2.

NO is oxidized to NO_2 mainly by reaction with ozone. Within 5 km of the source less than 20 per cent of the NO will have converted to NO_2 under stable conditions. Under unstable conditions with more atmospheric mixing up to 50 per cent of the nitric oxide may have converted to NO_2. The rate of conversion of nitric oxide to NO_2 increases with rising ozone concentration, wind speed and solar radiation.

For assessing the impacts on air quality of emissions to atmosphere from large combustion sources, such as gas-fuelled power stations, it is important that realistic estimates are made of how much nitric oxide would be oxidized to nitrogen dioxide at all receptors considered.

The rate of oxidation of nitric oxide to nitrogen dioxide depends on both the chemical reaction rates and the dispersion of the plume in the atmosphere. The oxidation rate is dependent on a number of factors that include the prevailing concentration of ozone, the wind speed and the atmospheric stability.

Between 1975 and 1985 about 60 sets of measurements were made of the concentrations of nitric oxide and nitrogen dioxide in various power station plumes. These measurements were carried out under widely varying weather conditions at altitudes between 200 m and 700 m. From the data collected, an empirical relationship for the percentage oxidation in a power station plume based on

downwind distance, season of the year, wind speed and ambient ozone concentration may be described by the following equation (which is sometime referred to as Janssen's equation):

$$NO_2/NO_x = A\left(1 - \exp^{(-\alpha x)}\right)$$

where x is the distance downwind (km) of the emission point and α and A are constants dependent on time of year and derived from the measurements of wind speed and ozone concentrations.

For a typical power station the peak ground level concentration of the oxides of nitrogen will occur within a few kilometres. The empirical relationship has been used to estimate the percentage oxidation for each hour during 2004 for downwind distances from the proposed plant. These estimates were made using hourly average meteorological data from Boulmer and hourly average ozone concentrations from Middlesbrough, the nearest monitoring site which measures ozone. Table 6.10 shows the minimum, maximum and annual average estimates of NO_2 in the plume for selected distances downwind of the plume, the figure takes into account the ratio of NO to NO_2 in the plume on exit from the stack.

TABLE 6.10
ESTIMATES OF THE PERCENTAGE OF NITROGEN DIOXIDE (NO_2) IN OXIDES OF NITROGEN (NO_x)
2004

Downwind distance (km)	Percentage nitrogen dioxide (NO_2)		
	Lowest one hour average	Highest one hour average	Annual average
1	2.4	16.0	6.8
2	4.7	29.0	13.0
3	6.8	39.7	18.5
5	10.8	55.6	27.9
10	19.3	76.1	44.7

Based on the principles outlined above, the average proportion of nitrogen dioxide within 2 km of the stack will be 13.0 per cent. The highest percentage oxidation for any hour during 2004 for impacts that occur within 2 km of the stack is 29.0 per cent. The predictions therefore suggest that out to distances of 3 km from the proposed site, the percentage oxidation of nitric oxide to nitrogen dioxide in the plume will on average be just over 18.5 per cent.

The maximum conversion factor calculated for each receptor can been applied to the predicted levels of NO_x due to the generating plant to give a conservative estimate of NO_2 contributions at each individual receptor based on the data in Table 6.14 and the distance of the receptor from the stack modelled. As part of the calculation of the conversion the proposed stack will be used as the reference point for the conversion.

6.5.5 Control of other emissions

In addition to the heavy duty cyclones a separate fabric (bag) filter will be used to reduce the particulate concentration to 20 mg/Nm^3. Calcium oxide (CaO) may also be injected into the combustion gases to minimize halides and sulphur concentration should this be required though this is considered to be unlikely as the sulphur content of the wood chip fuel will be low and the wood ash is naturally rich in alkaline components that scrub acid gases.

6.5.6 Stack height

The stack height sensitivity study examined stack heights of 55 m, 65 m, 75 m, 85 m, 95 m, 105 m and 115 m. The stack height sensitivity considered the both NO_2 and SO_2 pollutants.

The stack height modelling results have been compared against the EA's Technical Guidance note H1. The modelling results can be considered to be "significant" if the ground level concentrations exceed 10 per cent of the short term objectives/EAL (up to 24 hour averages) and 1 per cent of the long term objectives/EAL (monthly/annual results etc).

It is assumed that the plant is operating at full load for 8760 hours. Hence the worst case scenarios have been considered. Initial modelling has suggested that the meteorological data for 2003 results in the highest predicted concentrations therefore this has been used for detailed analysis of the stack height. Further details of the modelling input parameters can be found in Table 6.14.

6.5.6.1 Nitrogen Dioxide

The stack height study predicted the 19th highest hourly and annual NO_2 ground level concentrations for the typical operation of the proposed plant ie woodchip firing. The 19th highest hourly value is obtained as it allows for abnormal weather conditions which may only occur for one hour during the year to be disregarded as these weather conditions can not be mitigated for in any significant way. A derived approach for NO_x to NO_2 conversion, as discussed in Section 6.5.4 has been used for both the 19th highest hourly and annual concentrations for each stack height. The results using both are shown in Table 6.11.

TABLE 6.11
STACK HEIGHT SENSITIVITY
FOR NO_2
($\mu g/m^3$)

Stack height	19th Highest hour	Annual
55	15.6	0.8
65	11.9	0.4
75	9.3	0.3
85	7.6	0.2
95	6.4	0.2
105	5.3	0.1
115	4.7	0.1

The data in Table 6.11 is shown graphically in Chart 6.1 and Chart 6.2

CHART 6.1
STACK HEIGHT SENSITIVITY
MAXIMUM 19TH HIGHEST HOURLY NO_2
($\mu g/m^3$)

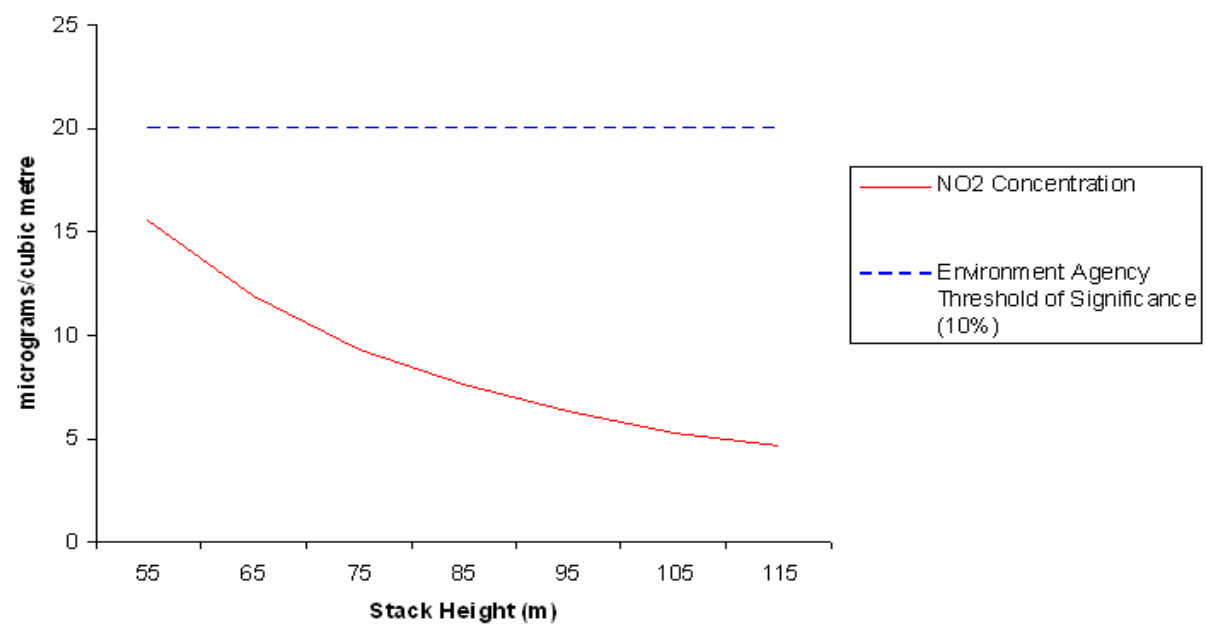

Chart 6.1 shows that the predicted 19th highest hourly concentration decreases for an increase in stack height when the Tees REP is in full operation. The predicted ground level concentrations have been compared against the EA threshold of significance in Horizontal Guidance Note H1, ie 10 per cent of the short term AQA objective for NO_2 of 200 $\mu g/m^3$. Chart 6.1 shows the short term NO_2

ground level concentrations are well below the short term EA threshold of significance of 20 μg/m^3 for all stack heights considered.

CHART 6.2
STACK HEIGHT SENSITIVITY
MAXIMUM PREDICTED ANNUAL AVERAGE NO_2
(μg/m^3)

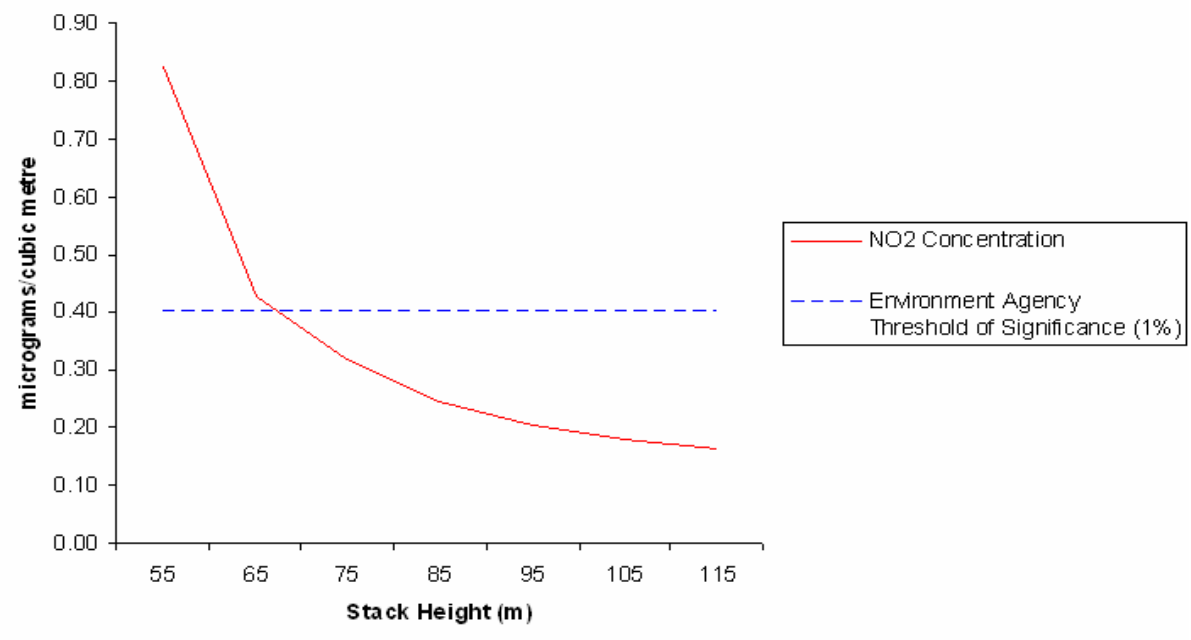

Chart 6.2 shows that the annual concentration of NO_2 decreases for an increase in stack height when the Tees REP is in full operation. The predicted ground level concentrations have been compared against the EA threshold of significance in Horizontal Guidance Note H1, ie 1 per cent of the long term AQS objective for NO_2 of 40 μg/m^3. Chart 6.2 shows that the annual NO_2 ground level concentrations are well below the long term EA threshold of significance of 0.4 μg/m^3 when a stack height of at least 65 m is considered.

The stack height modelling has shown NO_2 not to be a significant pollutant of concern. Short and long term ground concentrations are predicted to be below the EA Threshold of significance once the NO_X to NO_2 conversion has been applied, when a stack height of at least 65 m is considered. However, it was also considered appropriate to undertake a stack height analysis for SO_2, the other principal pollutant of concern, to ensure adequate flue gas dispersion.

6.5.6.2 Sulphur Dioxide

The stack height study predicted the 25th highest hourly and 15 minute mean SO_2 concentrations . The 25th highest hourly value is obtained as it allows for abnormal weather conditions which may only occur for one hour during the year to be disregarded as these weather conditions can not be mitigated for in any significant way. The results are shown in Table 6.12

TABLE 6.12
STACK HEIGHT SENSITIVITY
FOR SO_2
($\mu g/m^3$)

Stack Height	25th Highest hourly	15 Minute mean
55	249.5	348.1
65	90.9	97.3
75	50.6	57.0
85	32.3	37.4
95	23.9	27.3
105	17.8	21.1
115	13.4	17.1

The data in Table 6.12 is shown graphically in Chart 6.3 and Chart 6.4

CHART 6.3
STACK HEIGHT SENSITIVITY
MAXIMUM 25TH HIGHEST HOURLY SO_2
($\mu g/m^3$)

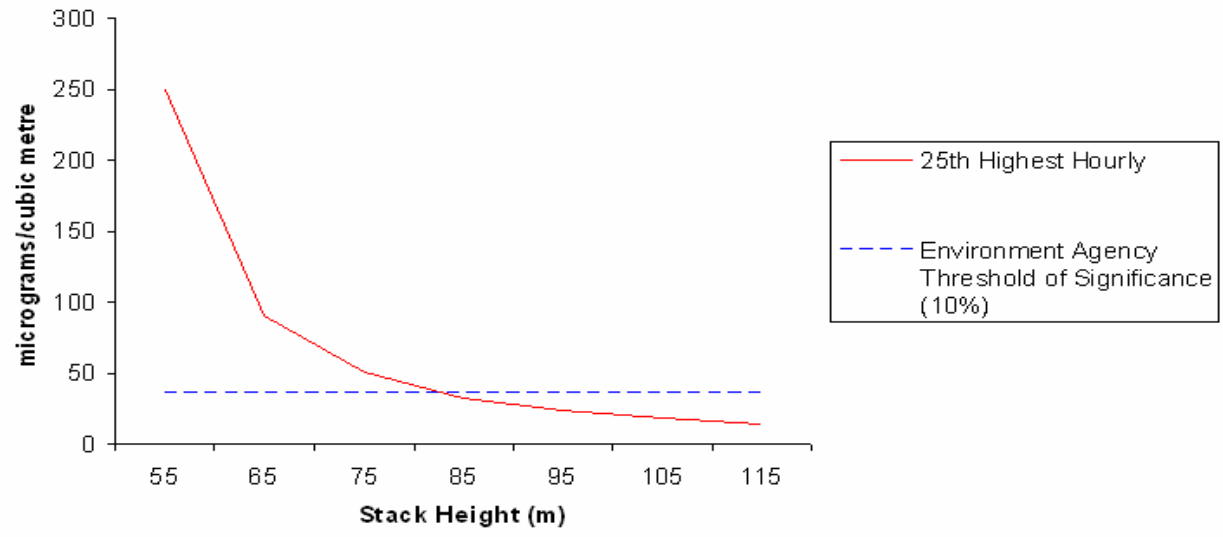

Chart 6.3 shows that the maximum predicted 25^h highest hourly SO_2 concentration decreases for an increase in stack height when the Tees REP is in full operation. The predicted ground level concentrations have been compared against the EA threshold of significance in Horizontal Guidance Note H1, ie 10 per cent of the short term 25th highest hourly AQA objective for SO_2 of 350 $\mu g/m^3$. A 95 m stack height is recommended as the short term SO_2 ground level concentrations for this height are well below the short term EA threshold of significance of 35 $\mu g/m^3$.

CHART 6.4
STACK HEIGHT SENSITIVITY
MAXIMUM 15 MINUTE MEAN SO_2
($\mu g/m^3$)

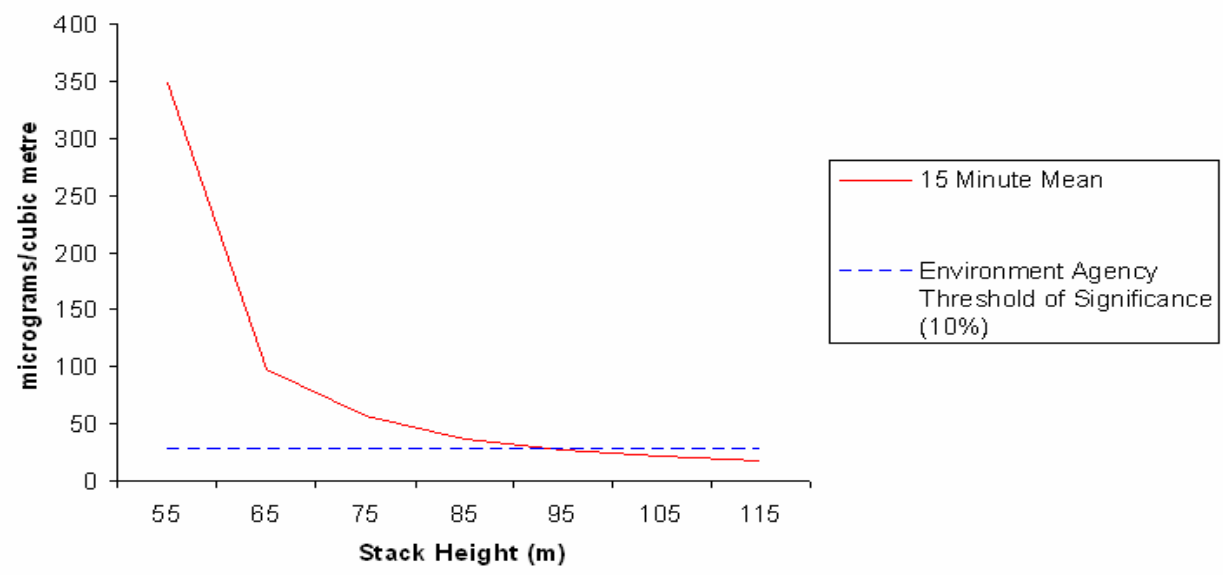

Chart 6.4 shows that the maximum predicted 15 minute SO_2 concentration decreases for an increase in stack height when the Tees REP is in full operation. The predicted ground level concentrations have been compared against the EA threshold of significance in Horizontal Guidance Note H1, ie 10 per cent of the short term 15 minute mean AQA objective for SO_2 of 266 $\mu g/m^3$. Although the 15 minute mean SO_2 ground level concentrations for a 95 m stack height are slightly above the short term EA threshold of significance of 26.6 $\mu g/m^3$, this result is based on absolute maximum operation and therefore the prediction will be a over estimate. A stack height of 95 m is therefore confirmed to be significant for this averaging period.

On the basis of the stack height modelling undertaken for both NO_2 and SO_2 a stack height of 95 m is considered to be an effective stack height for the adequate dispersion of all plant pollutants.

6.6 Full atmospheric dispersion modelling

Atmospheric dispersion modelling can predict the ground level concentrations that occur due to the emissions from an elevated stack point source. This subsection describes the key aspects of the dispersion modelling process.

When flue gases are discharged from a chimney they have two sources of momentum. One is related to the velocity of discharge. This is usually designed to be in excess of 15 m per second as this value has been found to be sufficient to avoid immediate downwash of the plume, 25 m per second is generally applied to most power projects.

The momentum from the velocity of discharge is soon dissipated.

The second source of momentum is much more significant and is related to the discharge temperature of the flue gases. The flue gases being warmer than the surrounding atmosphere into which they are discharged, have a buoyancy and thus rise. This process continues until the flue gases have cooled to the same temperature as the surrounding air.

Mathematical models calculate the effects of these two sources of momentum and determine the height to which the flue gases will rise. This height plus the height of the chimney gives an effective chimney height.

The mathematical model then determines the dispersion of the flue gases from this effective chimney height. Note that the effective chimney height can be many times greater than the actual chimney height due to the large amount of heat present in the flue gases.

Dispersion occurs as a result of turbulence, and turbulence can result from both buoyancy effects and wind shear (also called mechanical) effects.

As an example of buoyancy effects, on a sunny day, solar heating creates turbulence by heating the ground and the air near the ground. The buoyancy of the heated bubbles of air causes it to rise, creating turbulence. These are the thermals experienced by small plane and glider pilots on sunny days. These can also rapidly disperse a plume in the surrounding air. At night, during stable conditions, the buoyancy effect is to suppress rather than cause or enhance turbulence.

Wind shear as a cause of turbulence is well known to pilots as well. Wind shear effects, important to air pollution modelling, result from high (several meters per second) wind speeds near the ground. Since the wind speed at the ground is zero, any high wind speeds result in substantial wind shear. Wind shear dominates over buoyancy effects not only under high wind conditions, but also near the ground under any conditions.

As a result of this, two parameters are used to define the “stability” of the atmosphere. The first is the friction velocity. This is a measure of wind shear. Shear stress per unit mass has the units of velocity squared. The square root of this is the friction velocity.

The second parameter is a stability term called the Monin-Obukhov length. As mentioned above, shear stress always dominates near the ground. The height above the ground, where buoyancy effects begin to dominate (generating turbulence in convective conditions or suppressing turbulence in stable conditions) is called the Monin-Obukhov length. This can be thought of as a depth of the neutral (ie shear-dominated) flow. The Monin-Obukhov length is positive for stable conditions, and negative for convective. Near-neutral conditions are characterized by very large negative, or very large, positive Monin-Obukhov lengths. Very stable conditions have Monin-Obukhov length of a few metres to a few tens of metres, while very unstable conditions have negative lengths of about the same size.

6.6.1 The dispersion model and inputs

The dispersion models available and accepted by the Environment Agency, for point sources are AERMOD and ADMS. Both are second generation models developed in the US and the UK respectively.

ADMS 4 was preferred for the modelling of the proposed plant due to its shorter running times than AERMOD 6.

Building downwash structures are those which subject the plume from the stack to wake effects. The effect is generally to pull the plume down to the ground closer to the stack and not allow the plume to disperse as effectively thus increasing ground level concentrations. Potential downwash structures are those which are located within 5L of the stack, L, being the lesser of the height of the building, and the maximum projected width of the building. Additionally if a stack is higher than the height of the building plus 1.5L then the building is not a downwash structure. The buildings included in the modelling exercise are shown in the Table 6.13 below.

TABLE 6.13
BUILDINGS INCLUDED IN THE MODELLING EXERCISE

Building	Height (m)	Width (m)	Length (m)	Distance from stack (m)
Main Boiler House	55	45	45	98
Air Cooled Condenser	40	75	65	209
Front of Boiler House	45	16	35	69

The ADMS model calculates time averaged ground level concentrations over any set of distances from the source. The study used a 20 km by 20 km Cartesian grid with 200 m spacing and an 11.2 km by 11.2 km Cartesian grid with 112 m spacing to predict the ground level concentrations associated with the scenarios identified. This grid was centred on the site centre 454124, 523184.

Following early consultation with the Environment Agency, the meteorological data used for this modelling exercise was that from the station at RAF Boulmer. The data periods considered were the years 2003-2007 inclusive. Although the meteorological station at Newcastle Upon Tyne is closer in proximity to the Tees REP site the meteorological data from Boulmer is considered more suitable giving its coastal location Other developments in the vicinity of the Tees REP site have also used meteorological data from Boulmer for their air quality modelling because of this reason.

For each year the predominant wind direction was from the southwest and southeast. The windrose for 2003 can be seen in Figure 6.1.

Terrain effects generally occur when ground levels within 1 km of the stack vary by more than a third of the stack height. For the proposed site the land does not rise above about 10 m AOD within 1 km therefore terrain data has not been included in the dispersion modelling exercise.

6.6.2 Plume visibility

Industrial scale combustion activities can at times result in the release of a visible plume of steam from a stack. Under usual meteorological conditions in the UK, such plumes are rarely visible, only

becoming visible when the water content of the air exceeds its holding capacity at that particular temperature.

Up until recently, existing thermal power stations in the UK (firing on gas, coal or oil) inherently produce few visible plumes due to the relatively low moisture content of the fuel. However, the advent of flue gas desulphurization now being retrofitted to many coal fired power stations means that visible plumes of white water vapour are unavoidable. A wood fired plant such as that proposed at Tees REP, by its nature, fires a fuel with a higher moisture content and therefore is more likely to produce a visible steam plume.

The 'Plume Visibility' module in ADMS 4 takes as its inputs:

- Surface humidity (provided by the Met Office in percentage terms as 'relative humidity');
- Surface temperature (the ambient air temperature); and the
- Initial mixing ratio in the plume of moisture per kg of dry release (expressed in kg/kg).

The model has been used to calculate the frequency of the plume visibility based on the above factors. The initial mix ratio is calculated from an exit gas moisture content of 17.87 per cent which corresponds to an initial mixing ratio of the plume of 0.13054 kg/kg.

6.6.3 Scenarios modelled

The scenarios considered represent the worst case operating scenarios as follows:

- Tees REP operating in isolation; and
- Tees REP operating in conjunction with the proposed Thor Cogeneration (Px), and proposed Teesside CHP (ConocoPhillips),

The Eston Grange IGCC project proposed by Coastal Energy has not been included due to information not being available at the time of this report in regard to the cumulative impact. However, a plant of this type should have exceptionally low atmospheric emissions and therefore it's omission should not significantly alter the conclusions set out below.

The normal operation of the plant will be the Tees REP operating on wood chip. The predicted concentrations are predicted to be worst case as baseload operation is assumed, where as in reality the plant may actually run at various loading regimes. The effect of this on predicted concentrations of NO_2 will be to reduce the long term average, as the plant is operating less, and also to potentially lower the maximum predicted short term averages, as the plant may not operate during the meteorological conditions leading to peak concentrations.

In the case of annual average concentrations these are calculated on the basis of the proposed plant operating for 8 760 hours per year at full load. This is considered to be very much a worst case, as

the plant will require outage periods for routine annual maintenance. A more likely operating scenario would be of the order of up to 90 per cent annual operation.

6.6.3.1 Scenario A – Tees REP operating in isolation

This scenario calculates the impact of the proposed Tees REP in normal operation ie operating on wood chip. Modelling has assumed that the plant operates at full load for 8760 hours per year ie the maximum permitted operation of the plant. The dispersion modelling inputs for this scenario are shown in Table 6.14.

TABLE 6.14
DISPERSION MODEL INPUTS TEES REP

Parameter	Units	parameter
Fuel input	kg/s	86.1
NO_x emission level	mg/Nm^3	150
NO_x flow rate	g/s	48.5
SO_2 emission level	mg/Nm^3	106
SO_2 emission rate	g/s	34.4
Particulate emission level	mg/m^3	20
Particulate emission rate	g/s	6.4
CO emission level	mg/Nm^3	100
CO emission rate	g/s	32.3
HCl emission level	mg/m^3	1
HCl emission rate	g/s	0.3
Temperature	C	95
Actual flue gas volume	m^3/s	530
Normal flue gas flow rate	Nm^3/s	323
Oxygen content	%	6
Flue gas velocity	m/s	25.5
Stack diameter	m	5.2
Stack height	m	95
Stack X coordinate	m	454124
Stack Y coordinate	m	523184

6.6.3.2 Scenario B –Tees REP operating in conjunction with Thor Cogeneration (Px) and Teesside CHP (ConocoPhillips)

This scenario calculates the impact of the proposed Tees REP operating in conjunction with the proposed Thor Cogeneration (Px) project a Combined Heat and Power (CHP) combined cycle gas turbine (CCGT) facility at Teesside and the Teesside CHP (ConocoPhillips) plant also at Teesside.

The two proposed projects in the vicinity of the Tees REP will run on natural gas during normal operation, and therefore for this scenario ADMS has been used to calculate only the annual average concentrations of NO_2 of each plant in isolation and also for the plants operating in conjunction with one another ie the cumulative impact. Short term averages have not been combined as in many instances the prevailing weather conditions of the maximums will be different. Modelling has assumed that the each plant operates at full load for 8760 hours per year ie the maximum permitted operation of each plant. The dispersion modelling inputs for this scenario are shown in Table 6.15.

TABLE 6.15
DISPERSION MODEL INPUTS OTHER PLANT

Parameter	Units	Thor Cogeneration (Px)	Teesside CHP (Conoco Phillips)
NO_x flow rate	g/s	36.4	36.119
Temperature	C	90	88.4
Actual flue gas volume	m^3/s	766.7	694.01
Flue gas velocity	m/s	27.1	33.3
Stack diameter	m	6	6
Stack height	m	75	90
Stack 1 X coordinate	m	451610	452804
Stack 1 Y coordinate	m	523279	524671
Stack 2 X coordinate	m	451678	452972
Stack 2 Y coordinate	m	523420	524663

6.6.4 Modelling results

A conservative view of the operation of the plant has been adopted in the modelling so that a “worst case” is presented. The purpose of using this approach is to ensure that the absolute maximum predicted impact within the potential operating regime of the plant is considered. This ensures that there is a “factor of safety” built into all of the air quality assessment, giving a high degree of confidence that the actual impacts will be less than those presented in this assessment. The results of the modelling have been compared to AQS objectives.

6.6.4.1 Scenario A – Tees REP operating in isolation

Table 6.16 and Table 6.17 present the worst case ground level concentrations predicted by the dispersion modelling for the pollutants considered in Scenario A. This table also shows the relevant UK guidelines and reports the location and direction of the maximum predicted. The tables indicate the meteorological data year for which the maximum was observed. Six isopleths have been prepared to show the distribution of the pollutant gases over the surrounding area. These are as follows:

- maximum 19th highest hourly increments to NO_2 concentrations;
- increments to annual average NO_2 concentrations,
- maximum 25th highest hourly mean increments to SO_2 concentration,
- maximum 4th highest 24 hourly mean increments to SO_2 concentration,
- maximum 36th highest 15 minute mean increments to SO_2 concentration;
- Increments to annual average PM_{10} concentrations.
- maximum 36th highest 24 hourly increments to PM_{10} concentration.

These are shown in Figures 6.2 through to 6.8.

TABLE 6.16
AVERAGE ANNUAL GROUND LEVEL CONCENTRATIONS
DUE TO SCENARIO A
($\mu g/m^3$)

Pollutant	Increment to ground level concentrations	Guideline	Distance (km)	Direction (degrees)	Year
NO_2	0.20	40	1.1	327	2003
Particulates	0.11	40	1.1	327	2003
HCL	0.01	0.75	1.1	327	2003

TABLE 6.17
SHORT TERM GROUND LEVEL CONCENTRATIONS DUE TO SCENARIO A
($\mu g/m^3$

Pollutant	Averaging Period	Increment to ground level concentrations	Guideline	Distance (km)	Direction (º)	Year
NO_2	19th highest hour	6.40	200	1.4	309	2003
SO_2	25th highest hourly mean	23.9	350	0.9	319	2004
	4th highest 24 hourly mean	13.3	125	1.1	310	2003
	36th highest 15 minute mean	28.5	266	0.8	309	2004
Particulates	36th highest 24 hourly mean	1.35	50	1.2	314	2003
CO	Maximum daily running 8 hour mean	0.02	10000	0.9	310	2003

6.6.4.2 Scenario B- Tees REP operating in conjunction with Thor Cogeneration (Px) and Teesside CHP (ConocoPhillips)

Table 6.18 and presents the worst case annual NO_2 ground level concentrations predicted by the dispersion modelling. The table shows the ground level concentrations for each plant in isolation and for the plants operating in conjunction with one another ie the cumulative impact. The table also show the relevant UK guidelines and reports the location and direction of the maximum predicted. The table indicates the meteorological data year for which the maximum was observed. One isopleth has been prepared to show the increments to annual average NO_2 concentrations when the plants are operating in conjunction. This is shown as Figure 6.9.

TABLE 6.18
ANNUAL AVERAGE NO_2 GROUND LEVEL CONCENTRATIONS DUE TO SCENARIO B
($\mu g/m^3$)

Plant	Increment to ground level concentrations	Guideline	Distance (km)	Direction (degrees)	Year
Tees REP	0.20	40	2.9	329	2003
Thor Cogeneration (Px)	0.39	40	3.9	295	2003
Teesside CHP (ConocoPhillips)	0.23	40	4.9	323	2003
All Plants in Operation	0.60	40	7.0	312	2003

6.6.5 Analysis of results

The results of the modelling have been compared to AQS objectives. Key findings from the analysis are:

- the predicted maximum long term NO_2 concentration when the proposed plant is operating in isolation is 0.2 $\mu g/m^3$, well within the long term AQS objective of 40 $\mu g/m^3$. The maximum concentration occurs at a point 1.1 km north west of the site in the vicinity of the ConocoPhillips industrial complex on the opposing side of the River Tees.

- the maximum short term NO_2 concentration when the proposed plant is operating in isolation is 6.4 $\mu g/m^3$, representing only 3 per cent of the AQS objective of 200 $\mu g/m^3$. This maximum concentration occurs at a point 1.4 km north west of the site over the ConocoPhillips industrial complex.

- the predicted maximum hourly and 15 minute mean SO_2 concentrations are 23.9 $\mu g/m^3$ and 28.5 $\mu g/m^3$ respectively,. The maximum hourly concentration represents 7 per cent of the 350 $\mu g/m^3$objective, while the maximum 15 minute mean concentration represents 11 per cent of the 266 $\mu g/m^3$ objective. Both maximums occur less than 1 km north west of the site in the vicinity of the ConocoPhillips industrial complex.

- the predicted maximum 24 hourly SO_2 concentrations at any receptor when the proposed plant is operating in isolation is 13.3 $\mu g/m^3$, which represents 11 per cent of the 125 $\mu g/m^3$AQS objective. This maximum concentration occurs 1.1 km north west of the site in the vicinity of the ConocoPhillips industrial complex.

- the proposed plant will not generate any exceedances of the short term AQS objective for carbon monoxide or particulates with the predicted concentrations of these pollutants being negligible. Similarly the proposed plant will not generate any exceedances of the long term AQS objective for particulates or EAL for hydrogen chloride with the predicted concentrations of these pollutants again being negligible.

- there are no exceedences in the long term NO_2 objective when the plant is running in combination with the proposed Thor Cogeneration (Px) and Teesside CHP (ConocoPhillips) plant. Even in combination the 3 plants only just exceed a level 1 per cent of the AQS objective for annual NO_2.

- when combined with the existing ground level concentrations in the area it is not considered that there is any potential for the plant will give rise to exceedences of the long term NO_2 objective or in deed those for SO_2, PM_{10}'s, CO or HCl.

The maximum long term concentration of NO_2 due to the Tees REP are a small percentage of the long term NO_2 objective of 40 $\mu g/m^3$ and when considered in isolation is below the target threshold of 0.4 $\mu g/m^3$. When the proposed Tees REP is operating in conjunction with the proposed Thor Cogeneration (Px) and ConocoPhillips projects the combined annual ground level concentration is

slightly above the target threshold of 0.4 μg/m^3. However, this is based on absolute maximum operation of the three plants and therefore the predictions are overestimates. Operation of the plant in conjunction therefore will not significantly affect air quality in the surrounding area.

The maximum short term concentration of NO_2 are below the applicable AQS objectives in all locations when the Tees REP is considered in isolation. The plant will therefore never generate any exceedences of these standards in isolation. Short term concentrations for the proposed Tees REP, Thor Cogeneration and ConocoPhillips plants have not been combined as in many instances the prevailing weather conditions of the maximums will be different.

The maximum short term hourly concentration of SO_2 due to the REP are predicted to be low. The predicted maximum ground level concentration is 28.5 μg/m representing 11 per cent of the 15 minute mean SO_2 objective of 266 μg/m^3. Although this is slightly above the EA short term objective of 10 per cent of the limit the modelling has been based on a worst case operational scenario including year round operation and operation on a worst case fuel. The predictions, despite being low, are very unlikely to occur in reality.

In addition to examining the impact of the plant in isolation it is also important to consider the findings of the modelling assessment with the existing ambient air quality recorded in the vicinity of the plant.

With regard to the occurrence of long term maxima from the various types of sources the likelihood of them coinciding is high. This is due to the long averaging periods and the variation in meteorological conditions over the averaging period.

In 2005 the annual average concentration of NO_2 measured at Corporation Road in Redcar in the vicinity of the Tees REP site was 25.2 μg/m^3. Adding the maximum predicted increment due to the proposed plant to this figure and ignoring any contribution from the other two proposed plants, gives a total of 25.4 μg/m^3 which is well within the UK AQS Objective of 40 μg/m^3. Even when the other plants being developed in the area are considered the increment to existing ground level concentrations would not generate any exceedences of the AQS objectives for annual NO_2.

For short term averaging periods there is less likely to be such a coincidence of contributions from several sources. This is due to the weather conditions associated with the maximum from each type of source. Plumes from point sources, such as power station or boiler plumes generally provide a maximum increment to ground level concentrations when the weather conditions are warm and/or windy. Conversely the maximums associated with line sources, roads, occur when it is calm, cold and there is a low level inversion layer. During these times the thermally buoyant plume from a point source will burst through the inversion layer and disperse over a larger area. The inversion layer will severely limit the ability of the plume to ground, once the plume is above it. Therefore the maximum short term concentrations from each source type will not coincide and there will not be a summation combination of the effects of each. It is not therefore reasonable to sum the maximum contribution to ground level concentrations due to the plant in isolation with the existing monitored background level for short term concentrations. Never the less where short term results are considered against the results of the modelling of the REP it can be seen that even with addition of the concentrations there would be no exceedences of the short term AQS for any of the pollutant gases considered.

The location of maximum increments is indicative of the prevailing meteorological conditions, ie predominately south westerly/easterly winds. Much of the pollution is shown to ground over the industrial areas around the Teesport site.

6.6.6 Plume Visibility Results

Table 6.19 presents the results of the plume visibility modelling using the meteorological data from Boulmer meteorological station covering the years 2003 to 2007.

TABLE 6.19
PLUME VISIBILITY MODELLING RESULTS

Parameter		Year					
		2003	**2004**	**2005**	**2006**	**2007**	**Average**
No visible plumes predicted	Total number of hours	1245	1231	1314	1293	1303	1277
	Equivalent percentage of year	21	20	14	16	16	17
	Maximum length of plume (m)	517	545	546	546	546	540
	Average length of plume (m)	99	102	109	76	86	94

As can be seen by Table 6.19, the average number of steams plumes visible is 1315 hours per year which equates to an average of 17 per cent of the year. The length will not exceed 550 m with a length of 110 m being mode typical when the plume is visible at all.

Given the reasonably low frequency of visible steam plumes and the industrial setting of the site, plume visibility is considered to be of minor impact.

6.7 Mitigation

6.7.1 Construction

Good site management practices during the construction works will help to prevent the generation of airborne dust. MGT will require its construction contractors to take sufficient precautionary measures to limit dust generation.

To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the site or living nearby a dust monitoring programme will be carried out throughout the construction period. It is proposed that environmental monitoring of dust be carried out at areas of excavation, the

stockpiles, various additional locations across the site and at locations on the site boundary. A trained and competent person will carry out monitoring on a weekly basis. If dry windy weather prevails then the rate of monitoring will be increased. An aerosol monitoring system will be used. The results will be checked against Table 6.20.

TABLE 6.20
MAXIMUM ALLOWABLE EXPOSURE LEVELS

Dust	Monitoring location	Level	Action
Aerosol monitoring system (directional, with instantaneous read-out)	Excavation areas Stockpiles	>1 and <5 mg/m^3	Review PPE* level if >1 mg/m^3
Environmental Dust Sampler (gravimetric over fixed time period)		>5 mg/m^3 continuously	Stop work in breathing zone Identify cause and carry out remedial work Review PPE level, go to level 2 respiratory protection Monitor every 30 minutes
	Site perimeter	0.2 mg/m^3	Stop work Identify cause and carry out remedial work
Visual and odour checks	Site wide	Excessive dust or odour	Further monitoring or control measures as appropriate. All such instances to be logged

*PPE - Personal protection equipment.

If the above values are exceeded then the rate of monitoring will be increased to four times a day or to a level consistent with the results that have been logged and additional remedial action as described below will be taken.

If a potential for dust emissions exists, for example on dry windy days, then the following procedure will be followed:

- materials will be tested for moisture content;
- if material is dry then water will be sprayed on to the working area to suppress dust;
- excavation faces not being worked will, if required, be either sheeted or treated with a chemical dust suppressant;
- in addition all operatives working in areas of potential dust emission will be provided with paper type face masks.

Materials deposited on stockpiles on site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a dust suppressant.

If finely ground materials are delivered, these should be in bag form or stockpiled in specified locations where the material can be suitably covered.

All vehicles carrying bulk materials into or out of the site will be covered to prevent dust emission. Minimum drop heights will be used during material transfer.

Dust emission from moving construction plant and site transport will be mitigated by the use of water bowsers, which will dampen all movement areas being utilized by traffic.

A wheel washing facility will be provided adjacent to the site exit and will be used by all heavy commercial vehicles leaving the site, preventing the transmission of soil from the site to the public highway.

Road sweeping vehicles will be employed when required during the construction period to remove dust and dirt from all the public roads.

The above measures may only be necessary should the activities leading to the greatest dust generation occur during a dry period.

If care is taken dust emissions will not impact on local air quality.

6.7.2 Operation

The following mitigating measures have been included in the design of the proposed plant:

- the use of SNCR, which ensures NO_x levels to be in accordance with LCPD requirements;
- the use of a fuel inherently low in sulphur and ash;
- Bag filters to ensure that particulate matter emissions levels are kept below 20 mg/Nm^3.
- a stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.
- The use of completely enclosed storage buildings for the wood store, thereby avoiding any wood chip dust nuisance.

These measures, in combination, result in limited increases in background concentrations of oxides of nitrogen, negligible emissions of particulates and sulphur dioxide, such that no further measures are deemed necessary.

MGT will require a manufacturer's guarantee in place to guarantee the performance of the NO_x abatement system. If NO_x values are outwith the guarantee value the operation and calibration of the instrument will be checked and, if proved to be accurate, the plant will be examined and the fault corrected.

Emissions will be controlled during operation in accordance with the manufacturer's recommendations and the limits and conditions specified in the EPR permit for the process, taking account of the technical guidance available for this type of plant.

The stack will be fitted with continuous monitors for NO_X, CO, particulates and SO_2. The measured value will be recorded and displayed in the control room. Routine calibration checks will be carried out as recommended by the manufacturer and as agreed with the Environment Agency. Any other ad-hoc calibration checks required by the Environment Agency will be carried out. An oxygen monitor will also be supplied and results from this will be used to correct the NO_x measured value to the format required by the EA.

Sampling points and safe access adjacent to the continuous monitoring points will be installed.

Regular observation of chimney emissions will also be made.

6.8 Cumulative impact

Assuming an unlikely worst case scenario whereby the annual average contributions from the proposed Tees REP, Thor Cogeneration (Px) and ConocoPhillips projects occur simultaneously and at the same location, the increment to ground level concentration is estimated to be 0.60 $\mu g/m^3$.

This figure does not have to be compared against the long term NO_2 air quality objectives as it is resulting from multiple developments. This figure would equate to 1.5 per cent of the long term objective, which is only slightly above the target threshold of 1 per cent. This is based on absolute maximum operation of the three plants and therefore the predictions are overestimates.

It is therefore considered that the likely cumulative impact on air quality will be insignificant.

6.9 Conclusion

In conclusion, the emissions from the proposed plant will not impact significantly on local air quality.

The maximum long term concentration of NO_2 due to the emissions from the proposed Tees REP operating in conjunction with the Thor Cogeneration (Px) and ConocoPhillips CHP projects are a small percentage (<2 per cent) of the long term NO_2 objective of 40 $\mu g/m^3$.

The maximum short term concentrations from the Tees REP is never more than 4 per cent of the Environmental Quality Standard of 200 $\mu g/m^3$ for NO_2. The maximum short term concentrations of NO_2, SO_2 and particulates are below the applicable Air Quality Standards and will therefore never generate any exceedences of these standards in isolation.

The construction impacts would potentially comprise emissions of dust and emissions during commissioning. Due to the distance from the proposed site to the nearest house dust impacts will not be noticeable. Emissions during commissioning will be of short duration and low mass; the impact will therefore not be significant.

7. WATER QUALITY

7.1 Summary

The discharge of any effluents during construction, including site drainage, will be the responsibility of the construction contractor, who will be required by MGT Teesside to reach agreement with the Environment Agency and the local sewerage undertakers, Northumbria Water, with regard to the detailed methods of treatment and disposal. Industry standard good working practices will ensure that any impacts due to the water discharging from the site would be insignificant.

MGT Teesside has agreed conduits for the routing of process water and effluent interconnections through the PD Teesport estate. The supply of water for construction of the Tees Renewable Energy Plant (Tees REP) will be the responsibility of the construction contractor. It is expected that the water source will be the existing towns water supply to the REP site.

The construction of the plant will involve the uncovering and subsequent re-direction of the culverted Kinkerdale Beck. There are two options for the re-routing of the beck and these will be discussed with the relevant authorities prior to the commencement of any construction works to determine the most appropriate route. The two options include the routing of the beck east to the Teesport Dock or diverting it around the main items of plant before discharging to the existing release point to the north of the site. Care will be taken to ensure that the beck is not contaminated with made ground and that the water quality of the beck is not affected by redirecting.

During normal operation towns water will only be required on a day-to-day basis for make-up to the boiler water system and small domestic uses like operator toilet facilities.

The Tees REP will use air cooled condensers rather than a wet cooling tower or direct (river) cooling. This decision means that one of the major uses of water, and sources of effluent, has been avoided.

On a day-to-day basis, the only process effluent produced by the proposed plant will comprise the blowdown from the boiler and the demineralisation plant effluent. In addition there will be domestic effluents from the wash rooms across the site.

Small quantities of purified boiler water (boiler blowdown) are discharged in order to avoid the build-up of impurities in the boiler water. This discharge is virtually pure water, containing very small quantities of various chemicals that are used to prevent corrosion and scaling in the boiler. The boiler blowdown will be recovered and reused in the demineralization plant as much as achievable. The remainder will all be discharged to the existing system on the site.

The quality of the effluent to be discharged from the plant will be monitored for flow, pH, suspended solids and oils and grease. These discharges will be controlled to limits set by the Environment Agency in the plant's EPA Permit.

Any areas of the site that are likely to be contaminated with oil or suspended solids, including wood chip dust, will drain to oil interceptor(s) and solids filtration to limit visible oil in the water and to remove suspended solids. This filtered surface water, together with waters from non-contaminated areas, will drain to the River Tees.

The environmental impact of all discharges is not considered to be significant.

7.2 Introduction

This section considers water use at the proposed 300 MW Tees Renewable Energy Plant (Tees REP) and the disposal of its aqueous effluents.

Details of the assessment methodology and significant criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

7.3 Assessment methodology and significance criteria

7.3.1 Assessment methodology

All aspects of the water requirement for the proposed plant have been considered.

The source of the raw water was identified and the appropriate processing and storage methods were defined, based on the intended uses.

The assessment covered all major activities and processes that will generate aqueous effluents. The reason for use and the amounts of water required were specified and, where appropriate, the anticipated effluent compositions were established.

This section presents high level discussions of the likely mitigation measures to be employed as the exact nature of all effluents, including drainage systems, will be finalized during the design phase of the project. The plant will be engineered to adhere to the standards and limits set by the Environment Agency.

The discussions make reference to the applicable regulations and guidelines.

7.3.2 Significance criteria

The significance criteria of the impacts on water quality are defined as:

- High: Large, long-term, change to the water quality;
- Moderate: Small, or short-term, change to the water quality;
- Insignificant: No perceivable impact.

7.4 Baseline conditions and receptors

The REP is located on land immediately to the south of the River Tees. The river is a tidal saline water habitat subject to tidal fluctuations in level.

The main dock facilities at Teesport are located immediately to the east of the proposed site and serves an important import and export hub for the wider region.

In the past the site was crossed by the Kinkerdale Beck which was culverted in the mid 1990s and currently runs beneath the site exiting to the River Tees on the northern site boundary.

7.5 Potential impacts

7.5.1 Impacts on water quality during construction

A small amount of water will be required each day for the general construction works, this will be taken from the existing supply of towns water to the site.

Several construction activities could require the disposal of water from the site. MGT Teesside will require its construction contractors to reach agreement with the Environment Agency and if necessary the local sewerage undertakers, Northumbrian Water, with regard to the detailed methods of disposal.

Should a temporary diesel storage tank be necessary on site during construction, this will be double skinned or contained within a bund for prevention of releases to the environment, sized to hold 110 per cent of the tank's contents. Maintenance of construction machinery will not be allowed on site, which will help to prevent the accidental leakage of lubricating and hydraulic fluids.

Shallow groundwater contamination has been identified at the proposed site. Section 9.6.1.2 details the contamination found and how it will be managed during the construction period.

Construction activities may, if uncontrolled, potentially cause changes to surface water drainage due to the creation of soil piles. For that reason, grit interceptors will be in operation to prevent this from happening.

7.5.2 Impacts on water quality during operation

All water required by the plant will be taken from the existing towns water supply to the site. During normal operation water will only be required on a day-to-day basis for make-up to the boiler water system.

This water must be of high purity and will be treated in the water treatment plant. Together with the miscellaneous minor process requirement of 5 m^3/day the total quantity of towns water required by the plant will be of the order of 28.5 m^3 per day.

The towns water will be stored on site in the towns water storage tank. The lower portion of this tank will be dedicated to fire water storage and will supply the fire fighting system. The upper part of the towns water tank will be used to supply the water treatment plant and to supply water for domestic purposes.

Demineralized water from the water treatment plant is stored in an above ground storage tank.

7.5.2.1 Effluent discharge

Process effluents from the proposed project will comprise the following:

Boiler blowdown	before flashing-off to atmosphere	200 m^3/day
	after flashing-off to atmosphere	148 m^3/day
Water treatment plant effluent		60 m^3/day
Miscellaneous minor process effluents		5 m^3/day

The boiler blowdown will be recovered and reused in the demineralization plant as much as achievable. The remainder will be discharged to the site drainage system.

The quality of the effluent from the plant will be monitored. It is expected that the following parameters will be monitored: flow, pH, suspended solids and oils and grease.

These discharges will be controlled to limits set by the Environment Agency in the plant's EPA Permit.

The surface water from any areas of the site that are likely to be contaminated with oil or suspended solids will drain to oil interceptor(s) and filters to limit the oil in water content to a level regulated by the EPA Permit normally with a limit of "no visible oil" quoted (normally below 10 ppm) and to reduced the suspended solids to 30 mg/l before discharge to the storm water drainage system.

7.5.2.2 Boiler water

The boiler water/steam/condensate system has losses from its recycled water due to some deliberate blowdown from the boilers to maintain the correct chemical control. The water required to make up these losses must be of high purity and must therefore be treated in a water treatment plant.

Although of high purity, the feed-water entering the boilers will contain small amounts if impurities. As the water in the boiler is evaporated the impurities become concentrated in the boiler water system. To ensure that these impurities do not cause corrosion or scaling of the boiler heat transfer surfaces, treatment chemicals will be added to the boiler.

In addition, the concentration of the impurities is controlled by discharging some of the boiler water, either continuously or intermittently. This water is the "boiler blowdown". The blowdown water is replaced by fresh, treated water added to the boiler circuit. The boiler water will be dosed with treatment chemicals in order to control corrosion. As the feed-water will be of high purity the quantity of blowdown discharged from the boiler will be small, of the order of 200 m^3/day. The blowdown is discharged at boiler temperature and pressure.

Some of the blowdown flashes off to steam in the boiler blowdown vessel thus reducing the volume still further to about 148 m^3/day. Some of this boiler blowdown will be reused by recycling through the water treatment plant. It is virtually pure water containing very small quantities of various corrosion and scaling prevention chemicals in the boilers (for example, ammonia, phosphate and suspended solids).

A typical analysis of the boiler blowdown is:

Conductivity	50 μS/cm
pH	10
Ammonia as NH_3	1 mg/l
Phosphate as PO_4	5 mg/l

7.5.2.3 The water treatment plant

The water treatment plant will treat town's water to a quality suitable for use in the boiler. The water treatment plant will consist of the following: a raw water break tank, treated water storage tanks, two 100 per cent duty ion exchange streams, an acid storage tank, a caustic storage tank, an automatic effluent neutralizing system, a control panel and all interconnecting pipe work. The treated water storage tank will have a capacity sufficient to hold 700 m^3 of water.

The treatment process to be used involves filtration, followed by the exchanging of cations in the supply (calcium, magnesium, sodium, etc) for hydrogen ions by using cation exchange resins and then exchanging the anions in the decationized water (sulphate, chloride, carbonate, silicate, etc) for hydroxyl ions by using anion exchange resins. When the resins are exhausted the resin beds are backwashed, regenerated with dilute acid (for the cation resin) and with dilute caustic soda (for the anion resin), rinsed to remove any excess regenerant and returned to service.

The quantity of effluent produced per day from the water treatment plant will be of the order of 60 m^3/day during normal operation. A typical analysis is given below:

Calcium	950 mg/l
Magnesium	30 mg/l
Sodium	2,700 mg/l
Chloride	600 mg/l
Sulphate	7,100 mg/l
Nitrate	140 mg/l

The water treatment plant effluent will contain the salts removed from the town's water with some additional sodium sulphate produced by neutralization of the spent regenerants.

The quantity of town's water required by the water treatment plant to supply boiler water make-up will be about 660 m^3/day.

7.5.2.4 Site drainage

There will be four drainage systems on site; the surface water drainage system; the oily water drainage system; the contaminated waste water system (ie water treatment plant effluent); and the

sewerage system. There will be specific site drainage systems in the area of the ash storage and loading plant and the woodchip storage area.

The surface water drainage system will drain areas of the site unlikely to be contaminated with oil and discharge the water to the storm water drains. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from areas of hardstanding and roads. The proposed plant will not lead to significant quantities of surface water run off.

An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. This will discharge with the other surface water discharge to the storm water drains. The discharge from each oil interceptor will contain no visible oil or grease.

The areas liable to oil spillage are:

- the oil unloading area adjacent to the DFO tank
- the oil unloading area adjacent to the lubricating oil storage tanks;
- the electrical transformers (which may contain insulating oil; if so this will be PCB free);
- the areas surrounding the bunded lubricating oil storage tanks and the DFO storage tank (the bunds themselves will not have any drainage connections);
- any car parking areas.

Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be regularly emptied and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

The fuel storage area's surface water drainage system will feed to sumps and will pass through the oil interceptor prior to discharge to a dedicated surface water holding tank.

The contaminated water drainage system will collect all process effluents, (basically the water treatment plant effluent boiler blowdown and any miscellaneous plant drains) and discharge these to sewer.

The sewage will be collected separately and discharged direct to sewer.

All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

7.5.2.5 Miscellaneous discharges

Boiler flue gas side washing will occur at infrequent intervals (anticipated to be once every 5 years) during the life of the plant. It will be necessary to chemically clean the water side of the boiler tubes. All effluents will be tankered off site by a licensed contractor for treatment and disposal at an appropriately licensed disposal facility.

During maintenance it may be necessary to drain down the boiler, the closed circuit cooling water system or parts of these systems. All will be discharged to the site drainage system. The boiler water will be identical to boiler blowdown and will be high purity water containing traces of ammonia, phosphate and suspended solids. The closed circuit cooling water will be high purity water containing small amounts of corrosion inhibitor (probably hydrazine or nitrite/borate). During the detailed engineering stage, consideration will be given to the storage, recovery and reuse of these effluents.

Sample points will be provided on the outlet of the oil separators, and in any plant drains prior to discharge.

No prescribed substances as described in The Environmental Protection (Prescribed Processes and Substances) Regulations 1991 are generated or used on the site.

7.6 Mitigating measures and monitoring programmes

7.6.1 Construction

The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that should be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004: 1086. These will be taken into account.

Mitigation measures during construction may include, as appropriate:

- DFO storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.
- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil/grit interceptor(s) prior to discharge
- Measures to be taken to ensure that no leachate or any surface water that has the potential to be contaminated to be allowed to enter directly or indirectly any water course, underground strata or adjoining land.
- Provisions to be made so that all existing drainage systems continue to operate.
- Water inflows to excavated areas to be minimized by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.
- Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

The utmost care will be taken to ensure that there is no contamination of ground or surface waters. Section 9.10 outlines the mitigation measures that will be employed to ensure that this is achieved.

7.6.2 Operation

The Environment Agency (EA) will set limits on the quality of water that is discharged from the site under the EPR Permit.

All aqueous process effluents will be discharged to the plant via the drainage system and will be in accordance with EA limits. No on-site treatment will be necessary. This represents the best practicable environmental option for these effluents and is consistent with the approach suggested in Chapter 2 of the EA's PPC combustion Sector Guidance Note V2.03.

The water treatment plant effluent will be monitored for pH value. If the pH is outwith the limit of 6 to 9, or as permitted by the EA, the discharge will automatically stop until the failure is corrected.

All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and sight glasses will also be located within the bunded area. Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified prior to disposal.

The surface water drainage system will drain areas of the site unlikely to be contaminated with oil and discharge the water to the storm water drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from paved areas or roads.

An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.

Although the storage of the woodchip duel it is unlikely to constitute a significant pollution risk, there is a possibility for acidic run-off from the wood after heavy rainfall. Care will therefore be taken to ensure that the woodchips are only stored on site for short periods (30 days), which limits their potential to generate acidic decomposition products. Run-off from the wood stockpile will pass through an small effluent treatment plant to ensure it does not enter surface water (the River Tees or Kinkerdale Beck) without appropriate controls.

The ash removed from the boiler house will transported by a suitable closed conveyor to dedicated ash storage silos located adjacent to the boiler house. The removal ash is therefore unlikely to cause a significant pollution risk.

Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be regularly emptied and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

7.7 Assessment of cumulative effects

As there is no significant impact on water quality anticipated from the proposed plant with the project is considered to pose no risk of any cumulative effects.

7.8 Conclusion

The discharge of any effluents during construction, including site drainage, will be the responsibility of the construction contractor, who will be required by MGT Teesside to reach agreement with the Environment Agency and the local sewerage undertakers, Northumbria Water, with regard to the detailed methods of disposal. Standard good working practices will ensure that any impacts due to the water discharging from the site would be insignificant.

During operation the water will be supplied from the town's water supply, there will be no abstraction of process water from the River Tees. Process discharges from the site will be to sewer. Surface water will discharge to the River Tees via an oil interceptor and suspended solids filters.

The environmental impact of renewable energy development is not considered to be significant.

8. NOISE AND VIBRATION

8.1 Summary

This section aims to identify and assess the impact of noise and vibration due to the construction and operation of the proposed Tees Renewable Energy Plant (Tees REP) and auxiliary equipment.

The impact of construction noise is not predicted to be significant due to the distances between the proposed construction site and the noise sensitive receptors, and due to the temporary and changing nature of the noise source.

The impact of predicted operational noise has been assessed using BS 4142. The results of the assessment indicate that complaints would be unlikely at the nearest Noise Sensitive Receptors.

There will be no impact due to operational or construction vibration.

8.2 Introduction

This section aims to identify and assess the impact of noise and vibration due to the construction and operation of the proposed Tees REP. Details of the assessment methodology are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

Cumulative impacts of the plant and other developments in the vicinity are also considered.

8.3 Methodology

8.3.1 Overall approach

The following impact assessment focuses on six noise sensitive receptor locations, which are identified below. Existing baseline conditions at each location are determined by way of an attended noise survey.

A prediction of the impact during construction is undertaken following the methodology of BS 5228, and information regarding the noise output of specific items of plant contained therein. The noise and vibration impacts during operation are predicted using a noise propagation model, using typical values for the proposed plant items, and considering directional and screening effects. The significance of the predicted impact is assessed against the semantics of BS 4142.

This section also suggests planning noise limits based on the cumulative impact of both existing and proposed power stations operating together, and recommends mitigation options to control construction and operational impacts.

8.3.2 Legislative framework

The following legislative guidance is used for the assessment:

- BS 4142:1997 *'Method for rating industrial noise affecting mixed residential and industrial areas,'* BSI
- BS 7445: 1991 *'Description and Measurement of Environmental Noise' Parts 1 to 3,* BSI
- BS 5228: 1997 '*Noise and vibration control on construction and open sites' Parts 1 to 4*, BSI.

BS 4142 '*Method for rating industrial noise affecting mixed residential and industrial areas'* offers guidance on the assessment of industrial and commercial noise affecting residential and industrial areas. It describes a method for assessing whether industrial noise is likely to result in complaints from nearby residents.

BS7445 '*Description and Measurement of Environmental Noise'* defines and prescribes best practice during recording and reporting of environmental noise. It is inherently applied in all instances when making environmental noise measurements.

BS 5228 '*Noise and vibration control on construction and open sites*' gives recommendations for basic methods of noise and vibration control relating to construction sites and other open sites where construction activities are carried out. It offers a methodology for predicting noise levels from construction sites.

8.3.3 Noise Sensitive Receptors (NSR's)

A number of residential Noise Sensitive Receptors (NSR's) exist around the proposed sites. The following NSR locations were selected for monitoring:

- 1 Henry Street, South Bank
- 2 Normanby Road, Southbank
- 3 Elgin Avenue, Southbank
- 4 Blockow Road, Grangetown
- 5 West Coatham Lane, Dormantown
- 6 Tod Point Road, Redcar.

Figure 8.1 shows these locations in relation to the existing site. The figure also shows the location and extent of the proposed development in relation to the NSRs.

8.4 Baseline conditions

8.4.1 General

Baseline conditions were determined by way of an assessment to obtain existing noise levels at each NSR location. For the purposes of this assessment, noise from the existing plant is considered to be contributory to the baseline noise climate.

8.4.2 Noise assessment methodology

Full details of the methodology, results and conclusions of the noise survey undertaken for the proposed site are discussed in the Tees REP Noise Report in the Appendix E.

All monitoring was conducted using Class 1 Sound Level Meters. A field calibrator was used to calibrate and check the meter before and after the measurement period with no change in level recorded.

In accordance with the standards (above), the measurement microphones were positioned 1.4m above ground level, well away from vertical reflective facades. Weather conditions were conducive to successful monitoring, with zero precipitation and wind speeds of less than 5 m/s. A wind-shield was used to minimize the effects of wind noise.

8.4.3 Short duration measurements

At the same time as the long term monitoring, further measurements of short duration (or 'spot measurements') were taken at each of the NSR positions identified above.

Each measurement recorded the same five statistical parameters ($L_{A90,}$ L_{Aeq}, L_{Amax}, L_{A10}, L_{Amin}.) in unweighted third octave bands, with the overall figure reported using the A-weighed frequency network.

8.4.4 Results

Table 8.1 summarizes the lowest L_{A90} recorded at each NSR position, during the daytime and night-time.

TABLE 8.1
SUMMARY OF LOWEST RECORDED L_{A90}
AT EACH MEASUREMENT POSITION

Measurement Location		Lowest Measured L_{A90}		
		Daytime	Evening	Night
1	Henry Street	49	44	38
2	Normanby Road	53	45	33
3	Elgin Avenue	60	53	37
4	Bolckow Road	49	49	37
5	West Coatham Lane	45	49	44
6	Tod Point Road	38	39	39

8.5 Predicted Impacts during construction

8.5.1 Construction noise

Construction activity inevitably leads to some degree of noise disturbance at locations in close proximity to the construction activities. It is however a temporary source of noise. The noise levels generated by construction activities would have the potential to impact upon nearby noise sensitive receptors. Noise levels at any one location will vary as different combinations of plant machinery are used, and throughout the construction of the proposed plant as the construction activities and locations change. However, these would depend upon a number of variables, the most significant of which include the following:

- the noise generated by plant or equipment used on site, generally expressed as sound power levels;
- the periods of time construction plant is operational;
- the distance between the noise source and the receptor;
- the level of attenuation likely due to ground absorption, air absorption and barrier effects.

Construction noise predictions can be made based on the methodology outlined in BS 5228: 1997 '*Noise and vibration control on construction and open sites*'. Construction noise levels are predicted as a 'free field' equivalent continuous noise level averaged over a one-hour period ($L_{Aeq,1h}$), and then subsequently averaged over a 12-hour working day to give the $L_{Aeq,12h}$.

In the absence of specific information regarding the proposed construction plant and activities, it is possible to assess the potential construction noise impacts using the methodology set out in BS 5228 in conjunction with general information regarding proposed activities.

DoE Advisory Leaflet (AL) 72 (Reference 6) gives advice as to maximum levels of construction site noise at residential locations during daytime hours. The leaflet states that the noise level outside the

nearest occupied room should not exceed 70 dB(A) in rural, suburban and urban areas away from main road traffic and industrial noise. This increases to 75 dB(A) for urban areas near to main roads.

In 2005, the Department for Environment, Food and Rural Affairs (DEFRA) published an Update of Noise Levels for the Prediction of Noise on Construction and Open Sites, (Reference 7). This has been used to supplement the database contained in BS 5228. Table 8.2 shows the noise levels associated with typical construction activities, gives an indication of the distance at which the 70 dB(A) limit proposed by the DoE would be met, and predicts the likely noise level contributed by each item of plant at a distance of 2 km. (This distance represents the closest distance any item of construction plant could be to any of the noise sensitive receptors, and hence the worst case).

TABLE 8.2
EXAMPLE SOUND PRESSURE LEVELS ASSOCIATED WITH TYPICAL CONSTRUCTION ACTIVITIES

Construction activity/associated plant	Typical A-weighted sound pressure level (L_A) at 10m	Estimates sound pressure level (L_A) at 500m	Estimated sound pressure level (L_A) at 2km
Site preparation			
Dozer	75	41	29
Tracked excavator	78	44	32
Wheeled backhoe loader	68	34	22
Excavation			
Dozer	81	47	35
Tracked excavator	79	45	33
Loading lorry	80	46	34
Articulated dump truck	81	47	35
Rolling and compaction			
Roller	79	45	33
Vibratory plate	80	46	34
Piling			
Hydraulic hammer rig	89	55	43
Large rotary bored piling rig	83	49	37
Welding/cutting steel			
Welder (welding piles)	73	39	27
Generator for welder	57	23	11
Cutter (cutting piles)	68	34	22
Other			
Large lorry concrete mixer	77	43	31
Concrete pump (discharging)	67	33	21
Tower crane	77	43	31

The estimated sound pressure levels shown are worst-case estimates based on propagation attenuation only, and do not consider any screening, directivity or absorptive effects.

While it is not possible to predict an overall construction noise level at the NSR locations without detailed information regarding planned construction activity and plant, Table 8.2 indicates in this case the distances involved are large enough that the DoE level of 70 dB(A) will not be exceeded.

Considering the temporary and changing nature of the proposed construction works, the current levels of industrial noise due to the existing power plant, and the large distances between the proposed construction activities and NSR locations, the impact of construction noise is not predicted to be significant.

8.5.2 Construction vibration

Some construction activities can be a source of ground-borne vibration, which can be a cause for concern at the nearest receptors. Typical activities that would lead to vibration effects include compaction, breaking and piling.

The impact at the nearest properties from any vibration activities is a function of the vibration source and the propagation path to the receptor; larger distances reduce the impact. Due to the large distances involved, it is unlikely that construction vibration will be noticeable at the receptor locations. The impact of construction vibration will therefore be negligible.

8.6 Predicted impacts during operation

8.6.1 Operational noise prediction

Noise levels at the nearest sensitive receptors have been calculated using a three dimensional noise propagation model. The model has used typical sound power values associated with Biomass Generation Facilities, and has calculated the spread of noise using the algorithms contained within ISO 9613 Part 2. Corrections have been applied to account for:

- Distance propagation
- Directivity effects
- Screening effects due to existing buildings or plant, or other proposed on-site structures.

The model is intended to provide a worst-case assessment of the noise level likely to be experienced at each NSR location during moderate downwind conditions.

Table 8.3 presets the typical sound power levels associated with operation of Biomass generation facilities.

TABLE 8.3
TYPICAL SOUND POWER LEVELS ASSOCIATED
WITH OPERATION OF BIOMASS GENERATION FACILITIES

Plant	No Off	SWL
Air Cooled Condenser	1	98
Power House Building: Walls and Roof	1	97
Power House ventilation openings	1	89
Boiler House Walls & Roof	1	92
ESP and external ducting to stack	1	94
Stack Top Aperture	1	93
Unit transformer	1	91
Main transformer	1	99
Dump Condensers	1	103
Fin Fan Cooler	1	102
Conveyor: Silos to Boiler	1	99
Conveyor: To Stockpile	1	99
Fuel Silos: Screw Extractors	1	95
Ash Silos: Extractors	1	95
De-mineralization water building	1	91
Air compressor building	1	88
Workshop building: ventilation	1	71
Waste Water Treatment Plant	1	91
Sanitary treatment Plant	1	91
Oily Water treatment Plant	1	91
Stockpile: Loader Vehicles	2	105

Figure 8.1 shows the predicted L_{Aeq} noise contours during operation of the facility.

8.6.2 BS 4142 assessment

BS 4142 provides a methodology for the assessment of industrial noise in mixed residential and industrial areas. In this case, the standard suggests obtaining an assessment level by comparing the existing background noise levels with the 'rating level', which is the predicted noise output of the proposed industrial plant, corrected to account for any acoustic features such as tonal or impulsive noises. The semantics used for assessing the likelihood of complaints due to the introduction of a new industrial noise source are as follows:

- When subtracting the background level from the rating level, the greater the difference, the greater the likelihood of complaints.
- A difference of around +10 dB or more indicates that complaints are likely.
- A difference of around +5 dB is of marginal significance.
- If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

Since it is assumed that the predicted noise will not contain any acoustic features, no acoustic feature corrections need to be applied to the levels predicted.

Table 8.4 summarizes the predicted noise levels (constant A-weighted Sound Pressure Level, L_A) from the proposed plant only, at each of the six NSR locations. The measured background noise levels (L_{A90}), which include the influence of the currently operational plant noise, are also shown. The final column shows the excess of the predicted Rating Level over the measured existing Background Level.

TABLE 8.4
SUMMARY OF PREDICTED NOISE LEVELS AND BACKGROUND NOISE LEVELS AT EACH NOISE SENSITIVE RECEPTOR LOCATION

NSR Location		Predicted rating level from to proposed plant dB(A)	Lowest recorded background level L_{90} dB(A)	Excess of rating over backgound level
1	Henry Street	26	38	-12
2	Normanby Road	21	33	-12
3	Elgin Avenue	22	37	-15
4	Bolckow Road	23	37	-14
5	West Coatham Lane	17	44	-27
6	Tod Point Road	15	39	-24

At all locations the rating levels are more than 10 dB below the existing background level. In the semantics of BS4142, this gives a positive indicator that complaints are unlikely due to the proposed plant noise levels which suggests the significance of the noise impact at these positions can be considered negligible. Redcar and Cleveland Borough Council have been consulted regarding the predicted noise levels at the boundary of the plant. Figure 8.1 shows the predicted noise levels to be 50 dB, which the local authority finds to be acceptable.

8.6.3 Impact on nearby ecological receptors

The contribution of operational noise levels from the Tees REP at nearby wildlife sites to the north will be less than 25 dB(A). Although background noise levels have not been measured at these locations, due to the industrial nature of the area, the background levels are likely to be significantly greater than this level, and it is considered unlikely that the operational noise contribution from the Tees REP will be perceptible by any wildlife at the sites.

During the construction of the facility there is potential for construction noise to be intermittently audible at some wildlife sites, although this would not be at a level likely to cause disturbance, and would be temporary.

The impact of noise and vibration on the ecological sensitive receptors in the vicinity of the site is considered to be negligible both during construction and operation. Therefore, the impact on the ecological sensitive receptors has not been considered further in this assessment.

8.6.4 Operational vibration

It is predicted that on site vibration sources will include the following:

- Balanced rotating equipment, such as turbines;
- Wind induced vibrations in the stacks and condenser structures, to be transmitted to the foundations.

It is not anticipated that the level of induced vibration will be sufficient to propagate to the nearest sensitive receptors, from the centre of the proposed site, over the distances involved. Hence the impact of operational vibration is not assessed further.

8.6.5 Cumulative operational impacts

The cumulative operational impacts of the proposed Tees REP and the nearby Northern Gateway Terminal have been predicted at the noise sensitive receptors on Bolckow Road, Grangetown and West Coatham Lane/Wilton Avenue, Dormanstown. The predicted L_{Aeq} at the nearest noise sensitive receptors has been taken from the Northern Gateway Terminal Environmental Statement. Table 8.5 presents the predicted cumulative noise level of the Tees REP and the Northern Gateway Terminal against the lowest measured background noise level.

TABLE 8.5
SUMMARY OF PREDICTED CUMULATIVE NOISE LEVEL AND BACKGROUND NOISE LEVEL AT SELECTED NOISE SENSITIVE RECEPTORS

NSR Location	Predicted cumulative noise level of proposed developments (rating level) dB(A)	Lowest recorded background level L_{90}, dB(A)	Excess of rating over background level, dB
4 Bolckow Road	28	37	-9
5 West Coatham Lane	29	44	-15

At both locations the rating level is in the region of 10 dB below the existing background level. This is a positive indication that complaints are unlikely due to the combined operation of both the Tees REP facility and the Northern Gateway Port Terminal.

Due to the relative positions of both developments and these noise sensitive receptors, it can be concluded that complaints would not be likely at the other NSR locations considered in this report.

8.7 Noise and Vibration Control Measures

8.7.1 Control of Construction Noise

In order to keep noise impacts from the construction phase to a minimum, all construction activities would be carried out in accordance with the recommendations of BS 5228. In addition, the following mitigation measures would be implemented through the Construction Environmental Management Plan (CEMP):

- Core site working hours would be agreed with the Local Authority, and are specific to the construction site. These are generally Monday to Friday 0700 - 1900 hours and Saturday 0700 to 1700 hours. It would be necessary to work outside these core hours for certain activities but this would be with the prior agreement of the local authority.

- Specific method statements and risk assessments would be required for night working. In order to minimize the likelihood of noise complaints in such eventualities, the contractor would inform and agree the works in advance with the Environmental Health Officer, informing affected residents of the works to be carried out outside normal hours. Furthermore, the residents would be provided with a point of contact for any queries or complaints.

- All vehicles and mechanical plant used for construction would be fitted with effective exhaust silencers, and regularly maintained.

- Inherently quiet plant would be used where appropriate. All major compressors would be sound-reduced models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.

- All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.

8.7.2 Control of operational noise

This assessment has shown that the need for mitigation measures is not being driven by the predicted environmental noise levels due to Biomass Power Plant operations. However, inherently quiet plant items will be sourced wherever practicable as a means of best practise.

While planning noise limits will be agreed with the local authority at the planning consent stage, plant operators will aim to better these limits and reduce noise emissions as far as possible. The following measures would serve to continually monitor and minimize the impact of noise from the proposed power plant:

- In the event of a complaint by a local resident relating to noise levels during the operation of the plant, an investigation shall be carried out by the operator, or a representative thereof, to determine the likely cause of the complaint, and any available remedial measures. Where it is deemed necessary by the Local Authority, a written report detailing these measures and their effectiveness will be provided.

- In the interest of maintaining neighbourly relations and residential amenity, the company will give a reasonable period of notice to residents prior to any non-normal operations that would lead to an increase is noise levels. These will be carried out between 0900 and 1700 hours during the weekdays, wherever possible.

- A programme of noise monitoring, including a noise survey shortly following the commissioning of the new plant, shall be agreed with the Redcar and Cleveland Borough Council and implemented at regular intervals. The aim of these surveys shall be to ensure that plant noise levels as measured at the agreed NSR locations do not exceed the planning noise limits agreed with the local authority. Noise monitoring shall be undertaken in accordance with BS 4142.

8.8 Conclusions

The impact of construction noise is not predicted to be significant due to the distances between the proposed construction site and the noise sensitive receptors, and due to the temporary and changing nature of the noise source.

The impact of predicted operational noise has been assessed using BS 4142. The results of the assessment indicate that complaints would be unlikely at the nearest noise sensitive receptors.

There will be no impact due to operational or construction vibration.

9. LAND USE AND CONTAMINATED LAND

9.1 Summary

Baseline conditions have been assessed with reference to the Environmental Protection Act (1990), the contaminated land regulations (2006) and the Construction (Health, Safety and Welfare) Regulations (1996).

Information on the potential for land contamination has been obtained through a review of historical maps, as well as the Phase 1 Environmental Risk Assessment (Environ Consultants, 2007) and the Phase II Intrusive Site Investigation (RPS Health and Safety, 2008).

Potential sources of contamination are considered to be the backfill (made ground) used to re-claim the site from the River Tees and the previous use of the site as an oil storage depot. Potential sources of contamination also include the steel export terminal in the north-eastern area of the site and the (now disused) electricity substation in the centre of the site. Potential off-site sources of contamination include the adjacent SABIC chemical storage tanks.

During construction of the impacts on soils and geology are considered negligible, as they would be mainly confined to impacts to made ground. If any impacts occurred, they would be confined to localized, temporary erosion and compaction impacts caused by earthworks and vehicular movements. Due to the relatively small amounts of contamination at the site and the presence of the attenuating alluvial deposits underlying the made ground, it is not anticipated that significant concentrations of contaminant could leach to surface water or groundwater if properly mitigated.

During operation all areas of the site will drain to appropriate drainage systems on site thereby mitigating the potential for contamination of ground or surface waters. Disposal of all waste materials, whether hazardous or not, will only be via appropriate and authorized routes.

9.2 Introduction

This section details the baseline geological, hydrological and hydrogeological conditions at the development site and outlines the current and potential environmental impacts of the proposed development of the Tees Renewable Energy Plant (Tees REP).

The section also details the status of the site in terms of ground and surface water contamination and the risks posed to human health (particularly future site users).

Where potentially significant impacts have been identified, mitigation measures have been proposed to reduce the severity of such impacts to an acceptable level.

9.3 Site History

Historical maps show that prior to 1950, the site was part of the banks of the River Tees. Sometime between 1950 and 1970 the land for the site was re-claimed from the river and subsequently used for bulk storage tanks, most of which have since been removed. The contents of the tanks during this time are not known. In about 1973 a large steel transit shed was constructed in the north east of the

site. This export terminal still remains on site, but will be dismantled by PD Teesport prior to the MGT development works starting.

9.4 Geology and soils

Reference to the British Geological Survey (BGS) Sheet 33 (Stockton) 1:50,000 scale indicates that the site and much of the surrounding area is underlain by made ground. The made ground is shown to overlie estuarine and marine alluvium drift deposits. Bedrock underlying the drift deposits comprises Mercia Mudstone (Triassic age), which in turn is underlain by Sherwood Sandstone. A thin band of the Penarth Group is also noted to run between the alluvium and Mercia Mudstone Group, along the north-eastern part of the Teesport Estate. The Penarth Group comprises marine mudstones, limestones and thin bone beds.

The site and surrounding areas of Teesport and Southbank are classified as urban in character by the DEFRA Agricultural Land Classification (ALC) and as such there are no areas of fertile soil or agricultural land in the immediate vicinity of the site. The nearest area of good quality land (grade 2 quality) is approximately 5 km to the southeast of the site.

The ground conditions beneath the site are well understood. Extensive desk based studies have been undertaken in 2007, followed by a Phase II invasive site investigation including the sinking of a number of boreholes and digging of trial pits in 2008.

The geological sequence outlined by BGS sheet 33 was proven by the Phase II Contamination Assessment. A significant depth of made ground (average 5.9 m) was recorded in all boreholes and trial pits.

The Phase II investigation characterized the made ground as “grey/brown gravel of steel slag with cobbles and boulders up to 300 mm in diameter”. Underlying the made ground, alluvial deposits were recorded in 6 boreholes at depths between 5.45-12.2 m bgl. The alluvial deposits are characterized by dark grey/black silty sands or silts. Gravely clay was found between 12.2-12.6 m bgl in one borehole. The gravely clay is most likely associated with the Mercia Mudstone group. These deposits were not discovered in any other boreholes, although Mercia Mudstone is thought to underlie the entire site, based on BGS sheet 33.

Depth to base rock was not proven in any boreholes, suggesting that the Sherwood Sandstone Group underlies the site at significant depth.

There are no statutory or non-statutory sites designated for their geological importance in the vicinity of the proposed site, nor are there any features of geomorphological interest within the site boundary or surrounding area.

9.5 Hydrogeology

The estuarine and marine alluvium underlying the made ground is classified by the Environment Agency as a minor aquifer. This classification is given for deposits which are; *“Fractured or potentially fractured and which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits”.* Although these aquifers do not produce large

quantities of water for abstraction, they may be important for local supplies and in supplying base flow to rivers.

The Mercia Mudstone Group underlying the alluvial deposits is classified as a non-aquifer; these formations are generally regarded as containing insignificant quantities of groundwater and are therefore unimportant for abstraction or flow to rivers.

The Sherwood Sandstone which makes up the deeper solid geological deposits of the site is classified as a major aquifer. However, this is likely to be protected by the overlying non-aquifer of the Mercia Mudstone Group, depending on its extent and thickness across the site.

The soils underlying the site are classified as HU (high) leaching potential. This classification is for soils in which pollutants are likely to penetrate the soil layer. This is a worst case vulnerability classification, which is assumed until proven otherwise. However, these high leaching potential soils are unlikely to have a detrimental effect on the site unless there are significant amounts of land contamination.

There are two known licensed surface water abstractions within 1 km of the site. Both abstractions are from the River Tees and are for industrial uses. There are no known private water abstractions within 1 km of the site boundary. The site is not shown to lie within a Source Protection Zone (SPZ).

Groundwater was noted during the Phase II site investigation in six of the seven boreholes sunk. All groundwater strikes were recorded in the made ground between 3.54 m to 5.84 m bgl. It is likely that the shallow groundwater is in hydraulic continuity with the adjacent Tees Estuary. Groundwater is therefore estimated to flow in a north-westerly direction towards the Tees and is also likely to be tidally influenced.

9.6 Hydrology

The nearest surface watercourse is Kinkerdale Beck, which runs directly under the centre of the site and flows in a south-north direction into the River Tees; directly to the northwest of the site. According to historical records, Kinkerdale Beck was culverted beneath the site in 1994. The Environment Agency has not assigned water quality targets to the Kinkerdale Beck under the General Quality Assessment (GQA) scheme.

The nearest significant watercourse is the River Tees, immediately to the north and northwest of the site. The Tees is approximately 380 m wide at the location of the site and approximately 5 km to the west of Teesmouth Estuary. The Tees is tidal at this location and flows in a general southwest to northeast direction into the North Sea. The water quality of the Tees is classified under the Environment Agency's GQA scheme as grade B (good) at this point.

The only other significant water course in the area of the site is the Dabholm Gut, a tidal tributary of the Tees Estuary, located approximately 1600 m to the north of the site. It is highly unlikely that this water course will be influenced by the development works as it is not in the immediate vicinity of the proposed development.

There are no ponds or lakes within a 1 km radius of the site boundary.

The EA have designated part of the site as Flood Zone 3. Developments in Flood Zone 3 are considered to be *'at risk of flooding from rivers or sea if flood defences are not present'*. A separate Flood Risk Assessment has been undertaken and is included in Appendix D.

9.7 Contamination assessment

Information on the potential for land contamination has been obtained through a review of historical maps, as well as the Phase 1 Environmental Risk Assessment (Environ Consultants, 2007) and the Phase II Intrusive Site Investigation (RPS Health and Safety, 2008). The Phase II Intrusive Site Investigation report can be found in Appendix F.

The main potential sources of contamination are considered to be the backfill (made ground) used to reclaim the site from the River Tees and the previous use of the site as an oil storage depot in the 1960s. In addition, potential sources of contamination include the steel export terminal in the north-eastern area of the site and the (now disused) electricity substation in the centre of the site. Potential off-site sources of contamination include the adjacent SABIC chemical storage tanks.

Two historic landfills are recorded in the Teesport Estate which also have the potential to contaminate soil and groundwater on the site. The first is located in the area of the riverside Roll-on – Roll off loading area, approximately 300 m to the north of the site. The landfill was associated with the former Shell oil refinery and accepted a large quantity (equal to or greater than 75 000 tonnes, but less than 250 000 tonnes per year) of oil sludge waste.

The second is within the area of the existing container terminal and was operated by Tees and Hartlepool Port Authority. It accepted construction and demolition waste, road sweepings, slag and boiler and flue cleanings.

Both the above licenses have now been surrendered.

9.7.1 Overview of intrusive site investigation and data analysis

The Phase II Contaminated Land Assessment was undertaken in November/December 2007. Seven percussive boreholes were screened to a maximum depth of 12.6 m bgl and 17 trial pits were excavated to a maximum depth of 3.6 m bgl by mechanical excavator. Six ground water and gas monitoring wells were installed and monitored on three separate occasions. Two samples of surface water from Kinkerdale Beck were collected on one occasion.

9.7.1.1 Soil contamination

To assess the level of contamination across the site, 28 soil samples were taken from representative substrata from boreholes and trial pits and submitted to a UKAS accredited laboratory for the analysis of a range of determinands. The 28 soil samples consisted of 26 samples of made ground and two samples of (natural) alluvium.

The following contaminants were tested for:

- pH

- Metals
- Hydrocarbons (PAH, TPHCWG)
- Semi-volatile organic compounds (SVOC)
- Volatile organic compounds (VOC)
- Cyanide
- Phenols
- Polychlorinated biphenols (PCB)
- Asbestos.

Asbestos fibres were identified in one sample of made ground taken at a depth of 0.0-0.3 m bgl. Six further soil samples were submitted for asbestos screening; no evidence of fibres was found.

A total of 15 samples were submitted for petroleum hydrocarbon analysis. None of the samples had concentrations which exceeded the laboratory detection limit of 0.01 mg/kg. Similarly 15 samples were submitted for speciated poly-aromatic hydrocarbon (PAH) analysis. No samples had PAH concentrations above laboratory detection limit of 0.01 mg/kg.

Semi-volatile organic compounds (SVOCs) of Carbazole and Dibenzofuran were identified at concentrations greater than the laboratory detection limit of 0.1 mg/kg in four samples. Maximum concentrations of 22 mg/kg and 7.7 mg/kg respectively were found in trial pit 2. Trace concentrations of 4-methylphenol, 2 methylnapthalene, 4-nitroaniline, hexachlorobutadiene and hexaclorobenzene were also identified in three samples.

One sample taken from BH01 at a depth of 3.5 m bgl contained concentrations of volatile organic compounds (VOCS) exceeding the laboratory limit of detection.

pH ranged from 7.39 to 12.41, with a mean value of 8.96, suggesting that alkaline conditions prevail across the site.

No metal concentrations were identified in exceedance of the relevant screening criteria.

9.7.1.2 Groundwater contamination

Groundwater rest levels were recorded in six boreholes on five occasions, using a dip meter. Levels were also recorded in three boreholes over eight consecutive days using level loggers set to record at ten minute intervals.

A definite tidal cycle was observed in the groundwater levels of two of the boreholes. A maximum tidal range of 3.5 m was observed in BH03 in the north of the site.

Groundwater samples were collected for chemical analysis on two separate occasions from the six monitoring wells. Samples were analysed for a number of determinands, including:

- pH
- Heavy metals
- Petroleum hydrocarbons
- Polyaromatic hydrocarbons.

During groundwater monitoring, a strong odour was noted in waters collected from BH01 and BH04 to the south-west and south of the site respectively. In general, water samples were relatively clear, although all samples collected from BH04 were dark grey/black in colour with an oily sheen on the surface. Water collected from BH02 effervesced slightly on extraction.

Arsenic, copper and chromium concentrations were found to be elevated in one sample of groundwater from BH02 on one occasion (max concentrations of 26, 8.2 and 33 mg-kg respectively).

Selenium concentrations in all boreholes on both occasions were elevated above the WHO drinking water standards, with a maximum concentration of 77 mg/kg discovered in BH03.

One elevated concentration of benzene was recorded from one of the groundwater wells on one occasion. The same sample taken on the same date also had elevated concentrations of gasoline range organics (GRO) and ethyl benzene.

Petroleum hydrocarbon concentrations in exceedance of the laboratory limit of detection of 0.01 mg/kg were recorded in waters from BH01 and BH04.

Petroleum hydrocarbons exceeded the limit of detection on one occasion in BH02 and BH05.

9.7.1.3 Surface water contamination

Two samples were collected from Kinkerdale Beck on a single occasion and analysed for a suite of determinants including:

- Heavy metals
- Petroleum Hydrocarbons
- Polyaromatic Hydrocarbons.

Both samples were found to contain slightly elevated concentrations of copper. The concentration found up-stream of the site was higher than downstream of the site. In addition, these values are only marginal exceedences, and as elevated concentrations of copper were not found in the soil samples, it was concluded that the site is not having a detrimental effect on the water quality of the Beck.

9.7.1.4 Ground gas analysis

Concentrations of flammable gas, carbon dioxide and oxygen as well as flow rates were measured on six weekly occasions in six monitoring wells.

No significant concentrations of flammable gas or carbon dioxide (>0.2 per cent) were recorded in any of the boreholes. No significant flow rates (>0.2 or <-0.3) were recorded in any of the boreholes. Based on the above information, the potential for ground gas to cause significant harm to human health (construction workers or site staff) was considered negligible.

9.8 Impact assessment

9.8.1 Potential impacts during construction

9.8.1.1 Human health

During the construction phase of the project there is the possibility that site workers could come into contact with contaminated soil, surface water or groundwater. However, as the contamination is not widespread and not of a significant concentration, the potential for dermal contact is considered small providing appropriate PPE is worn.

In addition there is also a risk that contaminated soil particles may be inhaled by site workers or mobilized off-site. Again however, the risk is considered small, as contamination is not widespread. Although asbestos fibres were discovered in one sample, further analysis did not discover any further asbestos contamination, never the less care will be taken to ensure that where any such materials are encountered that they are dealt with in an appropriate manner.

Dust suppression measures such as dowsing stock piles with water will help to minimize the potential for dust migration minimizing the risk of dust inhalation by site staff and staff at neighbouring installations.

9.8.1.2 Underlying geology

Very little natural ground and no base rock will be lost due to the majority of the plant being constructed on made ground. There are no geologically designated sites or fertile soils within the immediate vicinity of the site. Therefore, the impacts on the surrounding soils, geology and geomorphology are expected to be negligible.

Surface water hydrology may be impacted by compaction of soils due to the construction of the hard engineering structures and intensive vehicular activity. The compaction of the soils will be minimized by restricting vehicle movements to specified routes and controlling the construction areas. In addition, a temporary site compound will be constructed for the parking of construction vehicles and equipment, staff vehicles, and the storage of materials.

Impacts on soils and geology are considered negligible, as they would be mainly confined to impacts to made ground. If any impacts occurred, they would be confined to localized, temporary erosion and compaction impacts caused by earthworks and vehicular movements. Impacts on near-surface soils would be within the construction footprint, laydown areas and access roads.

9.8.1.3 Surface water and groundwater

The construction of the plant will involve the uncovering and subsequent re-direction of the culverted Kinkerdale Beck. There are two options for the re-routing of the beck and these will be discussed with the relevant authorities prior to the commencement of any construction works to determine the most appropriate route. The two options include the routing of the beck east to the Teesport Dock or diverting it around the main items of plant before discharging to the existing release point to the north of the site.

Care will be taken to ensure that the beck is not contaminated with made ground and that the quality of the beck is not affected by redirecting it through made ground with high levels of contaminants.

During the construction period, the disturbance of large quantities of made ground could enable greater percolation of rainfall across the site and may enable the mobilization of low levels of contaminants. However, due to the relatively small amounts of contamination at the site and the presence of the attenuating alluvial deposits underlying the made ground, it is not anticipated that significant concentrations of contaminant will leach to surface water or groundwater.

The underlying Sherwood Sandstone group is considered a major aquifer, however, due to the significant depth of overlying Mercia Mudstone (non-aquifer) the major aquifer is unlikely to be impacted by any disturbance to the made ground.

Given the nature of the soils beneath the site piling for foundations will be necessary for items of plant such as the boiler, steam turbine, generator and more substantial storage tanks. Prior to construction, ground conditions will be tested to assess levels of sulphate. Based on the information obtained from these tests the correct concrete class, based on BRE Special Digest 1:2005 – Concrete in Aggressive Ground will be selected. The concrete associated with piling should therefore not lead to contamination of any ground water beneath the site.

The water bearing strata beneath the site is the Sherwood Sandstone. Although this is indicated by geology maps, sandstone was not recorded in any of the boreholes during intrusive investigations, suggesting that it is at a significant depth. However, groundwater was recorded at the site at depths of between 3.54 to 5.84 m bgl. Groundwater lowering and disposal may therefore be required in some areas of the site during earthworks. Surface water, perched waters (ie small pockets of water lying above the water table) or groundwater from dewatering operations will not be discharged to surface water, foul or surface water drains without the appropriate consents from Northumbria Water and/or the EA. The disposal of this effluent will be the responsibility of the contractor who if necessary will tanker this water off-site for disposal at a suitable facility.

Precipitation draining across exposed areas could result in a sediment surface run-off because of ground disturbance. Surface run off should be pumped off the soils and allowed to settle in a silt trap minimizing any impact to surface waters including the River Tees.

There is also the potential for spills/leakage of oil associated with construction machinery and vehicles. The storage of fuel, equipment and construction materials will be designed so as to minimize the risk of soil contamination or water pollution, for example through the use of bunds, drip

trays and oil interceptors in accordance with Environment Agency guidelines, PPG10 and Oil Storage Regulations.

9.9 Potential impacts during operation

Following development, the site will be predominantly covered with buildings or areas of hardstanding, there will be no areas of exposed (unvegetated) soils. It is therefore considered that the potential for direct (dermal, oral or inhalation) contact with any remaining contaminants present beneath the surface is negligible.

During operation all areas of the site will drain to appropriate drainage systems on site thereby mitigating the potential for contamination of ground or surface waters.

The main storage requirement on site is for the woodchip solid fuel. Although it is unlikely to constitute a significant pollution risk, there is a possibility for acidic run-off from the wood after heavy rainfall. Care will therefore be taken to ensure that wood chips are only stored on site for short periods (30 days). This will limit their potential to generate acidic decomposition products. Nevertheless run-off from the wood stockpile will pass through an small effluent treatment plant to ensure it does not enter surface water (the River tees or Kinkerdale Beck) without appropriate controls.

Only relatively small quantities of potentially hazardous substances will be stored and used at the site. These substances (detailed in Sections 4 of this ES) mainly comprise oil for plant start up and transformer and lubricating oils and small amount of chemicals for the boiler feed water treatment plant. Appropriate handling precautions will be detailed in an appropriate Environmental Management Plan (CEMP) which will be practiced on site.

Disposal of all waste materials, whether hazardous or not, will only be via appropriate and authorized routes.

There is the potential that if foundations are in contact with contaminated water or ground, the surface structure of the concrete can be attacked, causing leaching of calcium carbonate into groundwater or surface water. However, this is very unlikely at the current site in view of the high pH recorded in the bore holes and trial pits.

Sulphate, pH and magnesium testing will be conducted as part of a geotechnical investigation on site. Establishing the concentration of corrosive and organic contaminants such as these allows the identification of the appropriate concrete such that the concrete mix specified will resist attack.

Taking the abovementioned points into consideration, operation of the plant is therefore expected to have a minimal impact upon site geology, soils, hydrogeology and hydrology.

9.10 Potential impacts during decommissioning

The impacts on surface and ground water quality during decommissioning will be temporary and minor in nature and would be similar to those described above for construction (ie no significant impacts).

The foundations will be left in the ground after decommissioning the site. It is common for concrete foundations to remain in the ground for many years. The proposed foundations will consist of an appropriate concrete to prevent corrosive attack from contaminants and prevent leaching. There is not considered to be any significant environmental impact generated from these foundations. The ground will be reinstated back to its original state with topsoil and grass covering where appropriate.

9.11 Mitigation measures

During construction, all spoil will be stockpiled away from surface water and freshly excavated areas. A minimum distance of stockpiles from surface water should be discussed between the EA and construction contractors. Data from intrusive site investigations suggests that the site is not heavily contaminated, therefore, if there is any runoff from stockpiles this is likely to be clean. However, to prevent suspended sediments entering surface water, stockpiles will be covered with tarpaulin in wet weather to minimize runoff and infiltration from rainfall.

In order to limit disturbance and mixing between soils, groundwater and surface water during construction, the construction area will be delineated and no vehicle use will be undertaken outside the working boundary, other than on hardstanding or access roads. As the majority of the site is covered by road planning with minimal exposed soil, there are unlikely to be negative impacts arising from vehicle movements. In order to further limit disturbance, any additional site access roads required will be constructed prior to any on site excavations.

As there is a significant depth of made ground across the site, excavations for soil to be re-used on site are not proposed. In addition, any imported fill would be of sufficient quality so as not to require crushing with crushing plant.

Current access roads will be used for the site. These roads have been constructed with an appropriate camber and drainage so as to manage heavy rainfall. If any new access roads are required, they will be constructed to a similar standard, so as to cope with additional runoff caused by the site.

Precautions will be undertaken to ensure the complete protection of the watercourses in the vicinity of the site (River Tees and Kinkerdale Beck). In particular, no substance or drainage will be discharged to surface water unless agreed with the EA. In addition, pollution prevention measures will be vigilant on site to prevent any contamination of groundwaters.

A temporary wheel washing facility will be installed to prevent transfer of soil onto nearby public roads. Dust suppression measures will be in place on site to minimize dust levels on the site and in the surrounding environment (potential of inhalation of contaminants).

Excavation and foundation construction would be conducted in a manner that will minimize the size and duration of the excavated area.

All manual workers will wear appropriate PPE during the construction phase and strict hygiene measures will be adopted. Unsupervised man entry into excavations will be avoided.

Appropriate pollution prevention controls will be adopted on site at all times.

The contractor will provide a silt trap and/or oil interceptor at a location agreed with the EA to allow solids or immiscible liquids to settle/separate prior to discharge. The contractor will inspect, empty and maintain silt traps/interceptors as and when necessary. A registered waste carrier will remove from site all sludges or residues collected during cleaning operations off site to a suitably licensed waste disposal facility.

Any pumping of water from excavations will be undertaken at such a rate using an appropriately sized pump in order to avoid unnecessary disturbance or erosion. The location of dewatering pipework will be carefully positioned to minimize the risk of damage. The contractor will regularly inspect all dewatering pumps, pipe work and connections.

The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that would be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004:1986. These will be taken into account as necessary during the construction works.

Storage of fuel will be limited and secure. Temporary diesel storage tanks will be double skinned or contained with an impermeable bund, capable of holding 110 per cent of the tank's contents or 125 per cent of the aggregated contents of all tanks contained within the bund. Oil will be stored in accordance with the Oil Storage Regulations (2001).

Construction machinery will be checked regularly to prevent oil leaks or other emissions from faulty operation. Any maintenance required would take place over hardstanding or other impermeable ground cover. Refuelling will be limited to a designated area, on an impermeable surface, at a sufficient distance away from any drains or watercourses. Spill kits, absorbent geotextiles and absorbent sands will be available on site at all times, in accordance with the oil storage regulations (2001) and PPG 10. Any spills will be cleaned up as soon as possible, according to the spill response plan in the Working Practice Procedure, with any contaminated sands bagged up and disposed of correctly.

Parking of staff vehicles and equipment will only be permitted in designated areas.

Throughout the works, the Waste Management Duty of Care and Special Waste Regulations will be strictly adhered to, including the collation of all required paperwork and checking of transport and disposal contractors.

Spoil generated on site will be stockpiled, tested for waste acceptance criteria and geotechnical composition if necessary and removed off site by a waste contractor by appropriate means or re-used on site to fill excavations. Vehicles carrying wastes would be suitably sheeted/netted or appropriately covered to prevent the escape of waste materials en route. All works will be undertaken with reference to the Waste Management Duty of Care, imposed by Section 34 of the Environmental Protection Act (1990) and the Hazardous Waste Regulations (2005).

10. LANDSCAPE AND VISUAL

10.1 Summary

A landscape and visual impact assessment has been undertaken for the project including the preparation of photomontages based on a basic design concept from which an impression can be ascertained as to the likely scale and visual impact of the plant. The predicted views from eight viewpoints have been identified as being representative of the likely visual impact that would be encountered in the area.

The substantial buildings envisaged on site are the turbine hall, boiler plant, air cooled condenser, covered wood storage area and storage tanks. The remaining plant and equipment will, in the main, be housed in relatively low buildings, of the order of 3 to 6 m in height. The tallest structures on site will be the 95 m high stack and the 55 m high boiler.

The associated magnitude of change to the existing landscape is not predicted to be significant given the industrial setting of the site which already dominates the wider Teesside industrial area.

10.2 Introduction

This section presents the landscape and visual impact assessment for the proposed Tees Renewable Energy Plant (Tees REP) including consideration of the impacts to visual receptors as well as the landscape character of the area.

10.3 Assessment methodology and significance criteria

10.3.1 Assessment methodology

The Assessment Methodology used is based on revised guidance set out in 'Landscape and Visual Impact Assessment' published by the Landscape Institute and Institute for Environmental Assessment (2002).

The first stage of the assessment involves establishing the landscape and visual baseline of the proposed development site and the surrounding area, through desktop studies and field surveys. Sensitive landscape and visual receptors are then identified ie those landscape elements and features and visual receptors that are likely to be directly or indirectly affected by the proposed development.

Having drawn together the baseline information from the desktop study and the field survey, this information has been used to describe the character of the site itself and the local area.

The first stage of the baseline study involves the evaluation of the condition, quality and value of the landscape and existing views over the site, in order to assess the sensitivity of landscape and visual receptors to change.

The second stage of the assessment process initially involves the identification of landscape and visual impacts associated with the proposed development. Landscape and visual impacts or effects can be direct, indirect, cumulative, positive or negative and permanent or temporary. The

identification of impacts clearly distinguishes between those impacts upon the physical landscape resource and those associated with visual amenity and views across the site. Impacts are also considered in terms of their duration ie whether they are permanent (ie operational) or temporary (normally associated with the construction phase).

10.3.2 Significance criteria

This section discusses the significance criteria utilized to assess the impact of the proposed plant on both the receiving landscape and visual receptors.

10.3.2.1 Assessing landscape effects

Landscape effects are defined by the Landscape Institute as; '*changes to landscape elements, characteristics, character and qualities of the landscape as a result of development*'. The potential landscape effects, occurring during the construction and operation period may therefore include, but are not restricted to the following;

1. Changes to *physical fabric*: in reference to

   i. *landscape elements:* the addition of new elements or the removal of trees, vegetation and buildings and other characteristic elements of the landscape character type.

   ii. *landscape quality:* degradation or erosion of landscape elements and patterns, particularly those which form characteristic elements of landscape character types.

2. Changes to landscape character: landscape character may be affected through the incremental effect on characteristic elements, landscape patterns and quality and the cumulative addition of new features, the magnitude of which is sufficient to alter the overall landscape character type of a particular area.

3. Cumulative landscape effects: where more than one project may lead to a potential landscape effect

Landscape effects are assessed using a combination of factors;

- the sensitivity of the landscape (as identified in Table 10.1). The degree to which change from a particular development can be accommodated also takes into account aspects such as land use (the function of the landscape), the pattern/diversity and scale of the landscape, its openness, the value of the landscape resource including areas designated for such value, and scope for mitigation; and

- the scale or magnitude of effects (as identified in Table 10.2), considering the degree of change to the landscape resource.

The significance of effects is then assessed as a combination of sensitivity and magnitude of change, a process assisted by the use of Table 10.3, which may be used to guide the assessment.

The type of effect on the landscape may be described as 'permanent' (where the proposed development would be present within an area) or 'temporary' (where the proposed development would be present over a shorter period of time within the landscape), 'direct' (ie the loss of features contributing to the landscape character and resource) or 'indirect' (secondary effects such as the alteration to the landscape as experienced from the wider area), 'positive' or 'negative' and/or 'cumulative'. These effects are also considered as part of this assessment.

10.3.2.1.1 Landscape sensitivity and magnitude of change

The sensitivity of the landscape to a particular development is determined by reference to the baseline assessment of the existing landscape resource and is classified as high, medium, or low. Sensitivity is assessed by taking into account the existing landscape resource and its quality, value and capacity and in respect of the particular form and design of the proposed development (ie this wind cluster). Sensitivity may differ depending on the type of development proposed and needs to be considered on a case by case basis. The main factors to be considered are as follows:

- *Landscape quality*: The state of repair or condition of the elements of a particular landscape, its integrity and intactness and the extent to which its distinctive character is apparent. The quality of a landscape element or characteristic may also be influenced by the degree to which it may contribute to the overall landscape character, its rarity, and potential for replacement or mitigation. Landscapes of lower quality tend to include those under intensive agriculture, or urban fringe situations where the landscape elements and patterns have been eroded, almost creating a new and different landscape character. In these areas, the landscape management objectives may be focused on landscape repair, restoration, and enhancement.

- *Landscape value*: The importance attached to a landscape, often as a basis for designation or recognition, which expresses international, national or local consensus, because of its quality including cultural associations, scenic or aesthetic characteristics. In most cases, this is indicated by the presence or absence of a landscape planning designation such as a National Scenic Area or National Park indicating a landscape of national value or a locally designated landscape such as an Area of Great Landscape Value. It should be noted that a landscape of high or great value may not always equate to areas of high or great landscape quality (particularly if they are designated for other landscape and visual reasons) and that areas of low landscape value may contain areas of higher landscape quality.

- *Landscape capacity*: The capacity of a particular type or area of landscape to accommodate the proposed wind cluster development without unacceptable effects on its character. Many studies across the country have been conducted on landscape capacity industrial development and these can be referenced as appropriate.

The magnitude, or degree of change, considers the scale and extent of proposed change, which may include the loss or addition of particular features, and changes to landscape quality and character. Magnitude is defined as high, medium, low or negligible.

Table 10.2 is used as a general guide as to how magnitude is classified.

TABLE 10.1
CRITERIA FOR THE ASSESSMENT OF LANDSCAPE SENSITIVITY

Sensitivity	Criteria	Scale	Examples
High	Landscapes that are: • Highly valued • Particularly rare or distinctive • Susceptible to small changes	International National	World Heritage Site National Park National Scenic Area National Nature Reserves
Lower landscape capacity or scope for landscape change and **high landscape sensitivity**			
Moderate	Landscapes that are: • Valued more locally • Tolerant of moderate levels of change	Regional Local	Area of High Landscape Value (AHLV) Undesignated but value expressed in (for instance) demonstrable use
Moderate landscape capacity or scope for landscape change and **moderate landscape sensitivity**			
Low	Landscapes that are: • More commonplace • Potentially tolerant of noticeable change • Undergoing substantial development, such that their character is one of change	Local	Undesignated
Higher landscape capacity or scope for landscape change and **low landscape sensitivity**			

TABLE 10.2
CRITERIA FOR THE ASSESSMENT OF MAGNITUDE OF CHANGE

Level	Criteria
High	A noticeable change to the landscape over a wide area or an intensive change over a limited area
Medium	Minor changes to the landscape over a wide area or noticeable change over a limited area
Low	Very minor changes to the landscape over a wide area or minor changes over a limited area
Negligible	No or minimal perceptible changes to the landscape

The significance of the effects on the landscape are assessed using the following thresholds (Table 10.3), based on a combination of the sensitivity of the landscape and the magnitude of the change, and whether the change is temporary or permanent. The Guidelines for Landscape and Visual Impact Assessment state (par. 7.42):

> *"No [quantitative] formal guidance exists for the assessment of significance for landscape and visual effects and the assessor must clearly define the criteria used in the assessment for each project, using his or her skill based on professional judgement."*

TABLE 10.3
CRITERIA FOR DETERMINING SIGNIFICANCE

Significance	Definition guideline	Threshold
Major	A fundamental change to the environment	Noticeable change to a highly sensitive or nationally valued landscape, or intensive change to less sensitive or regionally valued landscape
Moderate	A material but non-fundamental change to the environment	Noticeable change to a landscape tolerant of moderate levels of change, or minor change to a highly sensitive or nationally valued landscape
Minor	A detectable but non-material change to the environment	Minor changes to a landscape considered tolerant of change
Negligible / None	No detectable change to the environment	No discernible change to the landscape

The above different grades of landscape sensitivity and magnitude of change have been provided in Table 10.4 as a guide to the landscape assessment process (note this table is also used to determine the level and significance of visual effects).

TABLE 10.4
SIGNIFICANCE OF LANDSCAPE IMPACT

	Magnitude of change			
Landscape sensitivity	High	Medium	Low	Negligible/None
High	Major	Major/moderate	Moderate	Moderate/minor
Medium	Major/ moderate	Moderate	Moderate/ minor	Minor
Low	Moderate	Moderate/minor	Minor	Minor/none
Key:		Significant		Not Significant

Mitigation measures are considered where there is scope for undertaking works that will assist in preventing, reducing or offsetting the adverse effects of the development. The main element of

mitigation incorporated into the scheme to prevent, reduce or offset any adverse effects has been the careful siting of the proposed plant and associated infrastructure.

10.3.2.2 Assessing visual effects

Visual effects are recognized by the Landscape Institute as a subset of landscape effects and are concerned wholly with the effect of the development on views, and the general visual amenity. The visual effects are identified for different receptors (people) who will experience the view at their places of residence, during recreational activities, at work, or when travelling through the area. The visual effects may include the following:

- *Visual effect*: a change to an existing view, views or wider visual amenity as a result of development or the loss of particular landscape elements or features already present in the view.

- *Cumulative visual effects*: the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect represented by the following scenarios;

    - *Combined or simultaneously visibility* – where the observer is able to see two or more developments from a single fixed viewpoint either in combination (where projects are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various developments).

    - *Sequential effects on visibility* – when the observer has to move to another viewpoint to see other developments or a different view of the same development (eg when travelling along a route).

10.3.2.2.1 Visual sensitivity and magnitude of change

Visual effects are assessed by considering the sensitivity of the visual receptor and the proposed magnitude of change. Other factors affecting visual sensitivity include the location and context of the viewpoint (in terms of the landscape value, quality, and capacity of the area within the view), the activity of the receptors, and the importance or popularity of the view and typical numbers of viewers. The evaluation of visual sensitivity is described further in Table 10.5.

The magnitude, or degree of change, is assessed by taking into account possible changes caused by the wind cluster, which may affect the view. Magnitude is defined as high, medium, low or negligible.

Table 10.6 is used as a general guide as to how magnitude is classified. The magnitude of visual change is described by reference to the following:

- The scale of change in the view (including extent and proportion of field of view affected – 90°) and the loss or addition of features in the view and changes in the composition and extent of view affected.
- The degree of contrast or integration of any new features or changes in the landscape with the existing or remaining landscape elements and characteristics in terms of mass, scale, colour and texture.
- The proximity and distance from the development and the speed at which the development may be viewed from a particular viewpoint.
- The angle of view from the main direction of view, elevation and openness of the view, and whether the development would be viewed against the skyline or a background landscape.
- The duration of the change, whether temporary or long term, intermittent or continuous and seasonal changes, due to periodic management and leaf fall.

TABLE 10.5
CRITERIA FOR THE ASSESSMENT OF VISUAL RECEPTOR SENSITIVITY

Sensitivity	Criteria	Scale	Examples
High	Views from: • highly valued landscapes • residential properties • long distance or strategic recreational footpaths • important recreational landscape features, beauty spots and picnic areas.	International National	World Heritage Site National Park National Scenic Area National Nature Reserves
Medium	Views from: • valued areas of landscape • local and less well used footpaths or tracks Receptors include; Walkers, cyclists, horse riders, road users and rail passengers	Regional Local	Area of High Landscape Value (AHLV) Areas of Great Landscape Value (AGLV) Landscapes of County Importance (LCI) Locally Important Landscapes Undesignated but value expressed in (for instance) demonstrable use

Sensitivity	Criteria	Scale	Examples
Low	Views from: • landscapes of lower value with low footpath or recreational use • non-designated farmland or moorland • commercial property outdoor recreation areas (eg playing fields) Receptors include; People at their place of work or taking part in activities not involving appreciation of the landscape.	Local	Undesignated

TABLE 10.6
CRITERIA FOR THE ASSESSMENT OF MAGNITUDE OF CHANGE

Level	Criteria
High	A major change or obstruction of a view that may be directly visible, appearing as a dominant feature and appearing in the foreground.
Medium	A moderate change or partial view of a new element within the view that may be readily noticed, directly or obliquely visible including glimpsed, partly screened or intermittent views, appearing as a prominent feature in the middle ground.
Low	A low level of change, affecting a small part of the view that may be obliquely viewed or partly screened and/or appearing as a visible feature in the background landscape. May include moving views at speed.
Negligible	A small or intermittent change to the view that may be obliquely viewed and mostly screened and/or appearing as a minor element in the distant background or viewed at high speed over short periods and capable of being missed by the casual observer.

10.3.2.2.2 Evaluating visual effects

The significance of the effects on the visual receptor are assessed using the following thresholds (Table 10.7), based on a combination of the sensitivity of the landscape and the magnitude of the change,

TABLE 10.7
CRITERIA FOR DETERMINING SIGNIFICANCE

Significance	Criteria
Major	A substantial deterioration or improvement to the existing view or situation
Moderate	A moderate deterioration or improvement to the existing view or situation
Minor	A small deterioration or improvement to the existing view or situation;
None	No change

The level of an effect is determined by the combination of sensitivity and magnitude of change, a process, which is assisted by the use of Table 10.8, which is used to guide the assessment. In terms of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 significant visual effects resulting from the proposed wind cluster would be all those effects judged to be either ‘major’ or ‘major/moderate’, adverse or beneficial. Minor effects are identified but are not considered to be significant, in terms of the EIA Regulations.

TABLE 10.8
SIGNIFICANCE OF VISUAL IMPACT

	Magnitude of change			
Visual receptor sensitivity	**High**	**Medium**	**Low**	**Negligible/ none**
High	Major	Major/moderate	Moderate	Moderate/minor
Medium	Major/moderate	Moderate	Moderate/minor	Minor
Low	Moderate	Moderate/ minor	Minor	Minor/none
Key:	Significant		Not Significant	

10.3.2.3 Type of effect

The type and probability of effect are also considered and included at the end of the assessment, these terms are defined below:

- *Temporary/Permanent*: The time period over which an effect may occur is referred to as 'temporary', 'long term', or 'permanent'.

- *Direct/Indirect effects*: The Landscape Institute defines these as effects, which are not a direct result of the development, but are often produced away from it or as a result of a complex pathway. Indirect effects are also used to describe those effects brought about by development that may be visible from a particular area of landscape character and or designated landscape, but not within it.

- *Beneficial/Adverse*: The landscape and visual effects may be beneficial, neutral, or adverse. In the case of an industrial development, the most noticeable effects and changes are likely to be visual, however the landscape and visual assessment guidelines do not allow for an automatic assumption that all change would result in an adverse effect.

- *Cumulative Effects*: Visual effects may also be cumulative with other existing, consented or proposed wind cluster development in the area.

In Visual Terms, beneficial or adverse effects are less easy to define or quantify and require a subjective consideration of a number of aesthetic factors affecting the view, which may be beneficial, neutral, or adverse. Opinions as to the visual effects of industry are however generally adverse. Rather this assessment should consider factors such as the visual composition of the landscape in the view together with the proposed development, which may or may not be reasonably accommodated within the scale and character of the landscape as perceived from the receptor location.

10.3.2.4 Viewpoint assessment

Viewpoint assessment is used to assist the LVIA and is conducted from selected viewpoints within the study area. The purpose of this is to assess both the level of visual impact for particular receptors and to help guide the assessment of the overall effect on visual amenity and landscape character.

10.3.2.5 Viewpoint selection

The seven viewpoints and visualization locations were selected. The selected viewpoints are representative of locations where views can be experienced from, settlements, publicly accessible roads, railways and footpaths, at different distances and directions from the site, as well as from the various landscape character types within in the study area. Detailed analysis of the viewpoints includes description of the existing and predicted view and analysis of the magnitude of change.

The aim of the assessment is to identify, predict and evaluate potential effects arising from the proposed development. The predicted magnitude and assessment of the significance of the landscape and visual effects will be quantified and interpreted by professional judgement on pre-defined criteria to provide consistency within the assessment.

Many of the key issues were considered through the viewpoint analysis in the field and viewpoints were selected by analysis of the visibility maps and through consultation. The viewpoints were chosen based on the following criteria:

- viewpoints should be representative of the likely impacts;
- viewpoints should show a range of different types of views;
- viewpoints should be representative of a range of different receptor groups;
- viewpoints should be representative of a range of distances; and
- viewpoints should be representative of the varying image of the wind cluster in the landscape.

Figure 10.1 shows the location of the viewpoints selected and also includes details of landscape designations in the surrounding area of the plant. Figure 10.2 provides a zone of visual influence diagram (ZVI) demonstrating the areas from which the plant might be visible. In each case the direction of view from the viewpoint is that towards the proposed site.

10.4 Baseline conditions and receptors

The landscape of the area is made up of the wider landscape associated with the Tees Lowland valley along with the more specific local landscape of the site itself.

10.5 Landscape assessment of Tees Lowlands

Natural England have nationally co-ordinated the identification of Landscape Character and Natural Areas. Together these reflect the division of England into areas with particular combinations of geology, soil, plants, animals, settlement history, land use, scenery, heritage and culture. Each area

has a defined local character, distinctiveness and sense of place. Although not based on administrative boundaries, these areas have long been recognized in topographical descriptions.

The Landscape Character and Natural Areas are designations of character not quality, and are independent of statutorily protected areas such as AONBs, Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs). The purpose of Landscape Character and Natural Areas is to ensure that by recognizing character, land management and new development can better respect location and associated ecology.

In many cases the Landscape Character and Natural Areas are further broken down by local councils. Redcar and Cleveland Borough Council have undertaken such a breakdown (Landscape and Character Assessment, April 2006) but only for rural areas of the Borough and therefore the study is not applicable to the project and the Natural England document is relied upon for the purposes of helping to define the local landscape character.

The site is situated in the centre of 'Tees Lowlands' Character Area (area 23) as designated by Natural England.

Natural England describes the 'Tees Lowlands' area as being a broad low-lying plain of gently undulating, predominantly arable, farmland with wide views to distant hills. Key characteristics of the area are noted as:

- The meandering, slow-moving river Tees flows through the heart of the area dividing the lowlands to north and south.
- Contrast of quiet rural areas with extensive urban and industrial development concentrated along the lower reaches of the Tees, the estuary and coast.
- Large-scale chemical and oil refining works, dock facilities and other heavy plants along the Tees estuary form a distinctive skyline by day and night.
- Overhead transmission lines and pylons, motorway corridors, railway lines and other infrastructure elements are widespread features.
- Woodland cover is generally sparse but with local variation such as at Skerne Carr, on steep banks of the middle reaches of the Tees, and to parkland and managed estates.
- Distinctive areas of peaty fenland □lats and carrs within the Skerne lowlands. Extensive areas of mud flats, saltmarsh wetlands and dunes at mouth of the river Tees which support valuable wildlife habitats.
- Minor valleys and linear strips of open land extend as 'green corridors' from rural farmland into the heart of the Teesside conurbation.

The Teesside conurbation is noted as forming an extensive area of urban and industrial development which spreads around the margins of the Tees estuary as an almost continuous built up area from Redcar to Billingham, with Hartlepool as a discrete settlement to the north.

Minor valleys and open strips of land are highlighted by Natural England as forming 'green corridors' linking rural farmland into the heart of the Teesside conurbation. High-rise buildings, large-scale chemical and oil refining works, dockside container terminals, a power station and other installations, all clustered on land reclaimed from the estuary at Teesmouth, are noted giving the landscape a distinctive and dramatic skyline which is highly visible across this low-lying landscape by day and night.

This extensive area of industry is starkly juxtaposed with the natural elements of the Tees estuary. Areas of open water, mud flat, salt marsh and meadow, including Seal Sands and the Cowpen Marshes, survive in amongst the industrial installations and are protected as habitats of outstanding importance for birds as well as offering an important archaeological resource.

10.5.1 Landscape character

The site is located on the southern bank of the River Tees in a heavily industrialized area. The proposed renewable energy development would be located on a 14 ha parcel of land immediately to the west of the main dock at Teesport (See Figure 1.1).

The proposed location for the renewable energy development currently comprises of unused industrial land mainly hardstanding interspersed with poor quality grass land. The land has been reclaimed from the sea in the 1950s.

The land within and immediately surrounding the proposed development site is fairly flat and low lying at approximately 5 m Above Ordnance Datum (AOD). To the south and west the land rises gently to around 20 to 40 m with the land rising sharply 4 km to the south around Eston Moor. The entire surrounding area is dominated by industrial development.

The landscape of the river to the north and east of the site is typical of the estuary. The land is flat with a mix of narrow streams and mudflats. On the opposing site of the river Tees the chemical plants at Billingham dominates the surrounding landscape.

The land immediately east, west and south of the proposed development site is industrial in use and character. Land to the east comprises of buildings associated with the Teesport site. To the south there is larger area on undeveloped land, which separates plant from the A66. To the west of the proposed site is a tank farm owned by Sabic (previously Huntsman Chemical) which is used for the storage of various chemicals.

Within these industrial areas there is little by way of trees or other forms of vegetation.

The main settlements in the area of the plant are Middlesbrough about 5 km to the west and Redcar 6 km to the east. There is no strong settlement pattern or architectural style which would characterize these areas.

10.5.2 Potential visual receptors

Figure 10.2 provides a ZVI for the 10 km surrounding the plant based on visibility of the 95 m high stack (the area shown in green) and the 55 m high boiler house (shown as the area in blue).

The figure shows that in theory the plant will be visible from much of the surrounding area however in reality the plant will be significantly obscured by existing industrial and residential development that will serve to greatly constrain the number of locations from which views of the plant will be achievable.

10.5.3 Illustrative viewpoints

For the purpose of this assessment seven viewpoints have been selected in order to illustrate the typical visual impact of the proposed development when viewed from the surrounding area. These viewpoints are described below and have been selected to represent key landscapes and visual receptors in the area of the proposed plant. Photographs and photomontages showing both the existing view and the anticipated view incorporating the proposed development are set out in Figure 10.3 to 10.10.

TABLE 10.9
ILLUSTRATIVE VIEWPOINTS

No.	Location	Comments	Sensitivity
1	Ledge Near Eston Beacon	**Special landscape area/area of historic landscape importance/recreational area**	Medium
2	Paddy's Hole – South Gare Breakwater	**Special landscape area**	Medium
3	Southgate Eston	**Residential**	Medium
4	Smith's Dock Road	**Road users**	Low
5	Footbridge Riverside Stadium	**Recreational (Middlesbrough football club)**	Low
6	Port Clarence	**Residential**	Low
7	Old Greatham Bridge – A178 Tees Road	**Road users/recreational (rspb planned reserve)**	Low
8	Teesmouth National Nature Reserve	**Recreational (beach users/nature reserve visitors)**	Medium

Viewpoint 1

The photograph shown in Figure 10.3 shows the view from the from the elevated area of Eston Moor, an area of historic landscape importance about 5 km to the south/south east of the proposed site. The viewpoint has clear views across the entire Tees Estuary. The moor rises to a summit at Eston Nab and is home to a number of historical features including Iron Age earthworks and Bronze Age burial mounds. The area also houses a Roman beacon station that linked the coastal beacon network to Catterick Garrison.

The existing view across the estuary from the site is not especially sensitive to change dominated as it is by the industrial zone centred around Teesport and the urban sprawl of Teesside in the form of

Easton to the east of the town of Middlesbrough. There are a number of visible plumes emanating from chemicals plants and power plant which further give add to the feeling of the area as being very much dominated by industry.

The viewpoint was selected to be representative of views from the area of historic landscape importance and special landscape area as designated by Redcar and Cleveland Council. The site is also representative of the experience of footpath, cycleway and bridleway users of the elevated area that make up Eston Moor.

Viewpoint 2

The photograph shown in Figure 10.4 shows the view from near the Marine Club on the South Gare Breakwater approximately 4.5 km to the north-east of the proposed site. The viewpoint is located within a special landscape area as designated by Redcar and Cleveland Council.

The existing views from the viewpoint towards the proposed site are dominated by the industrial plant of the wider Tees Estuary. In the left hand side of the picture the steel works owned by Corus can be seen complete with flare stack in operation whilst in the centre of the picture stand three large cranes located on the jetties on the southern side of Seal Sands. To the right of the picture is the large petrochemicals plant at Seal Sands whilst on the far right it is just possible to see Hartlepool Nuclear Power Station. In the foreground are the fishing boats that use the marine club as a home whilst not at sea.

The viewpoint was selected to be representative of views from the special landscape area as designated by Redcar and Cleveland Council.

Viewpoint 3

The photograph shown in Figure 10.5 shows the view from a viewpoint just to the north of the A174 on the southern most outskirts of Eston. As with the majority of the area the viewpoint is dominated by the industrial plant in the area. In addition the landscape is further cluttered by a number of transmission lines entering the existing Lakenby substation to which the proposed plant would connect via underground cable. The squat cooling tower of the soon to be re-powered Teesside Power Station can be seen in the right hand side of the picture.

The viewpoint was selected to be representative of views from the residential receptors at Eston and to some extent the motorists on the A174.

Viewpoint 4

The photograph shown in Figure 10.6 shows the view from Smiths Dock Road, which runs through an industrial area to the west of the plant. The area from which the picture is taken shows the industrial landscape that is typical of the area with the Sabic tank storage site which lies adjacent to the site in the centre of the photograph. There are a number of flood lights and other such structures in the area which provide lighting for the various industrial sites. The large transmission towers which are located close to the proposed site and carry the 400 kV line running from the Lakenby substation north over the River Tees can be seen on the horizon.

The viewpoint was selected to be representative of views experienced by road users.

Viewpoint 5

The photograph shown in Figure 10.7 shows the view from the bridge adjacent to Middlesbrough Football Clubs Riverside Stadium. The stadium can be seen to the right of the picture with the river Tees in the centre. Despite being very close to the centre of Middlesbrough the view is still industrial in nature with the Teesside industrial zone dominating the horizon.

The viewpoint was selected to be representative of views from the recreational area of the Riverside Stadium

Viewpoint 6

The photograph shown in Figure 10.8 shows the view from the northern edge of Port Clarence on the north bank of the River Tees. Despite being located fairly close to the Billingham industrial area the setting is relatively rural in nature with the majority of the surrounding land being pasture.

On the left hand side of the picture can be seen the north-western edge of the Billingham industrial area and the refineries and chemicals plant that form the majority of the areas industrial activity. Behind the slagheap in the centre-left of the picture it is possible to see the two tall suspension towers that carry the 400 kV line from the Lakenby substation north across the River Tees, just to the west of the proposed Tess REP.

The viewpoint was selected to be representative of views the residents at Port Clarence.

Viewpoint 7

The photograph shown in Figure 10.9 shows the view from Old Greatham Bridge where the A178 crosses the Greatham Creek, a tributary of the River Tees. The view is very much dominated by the Billingham industrial area with the Conoco refinery to the left of the picture, chemicals plant in the centre and the Petroplus refinery to the right of the picture.

Behind the Billingham site can be seen the elevated area around Eston Moor (see viewpoint 1) and behind that the North Yorkshire Moors National Park.

Just to the left of the picture the RSPB is in the processes of developing a nature reserve for birds.

The viewpoint was selected to be representative of views experienced by road users and .any future recreational users of the RSPB reserve.

Viewpoint 8

The photograph shown in Figure 10.10 shows the view from the area of Seal Sands and the Teesmouth National Nature Reserve. As with the majority of majority of the viewpoints the location is dominated by the adjacent industrial areas of the wider Teesside area. In the centre right of the photograph the Conoco Philips refinery can be seen against the horizon whilst in the left hand side of

the photograph the large crane of Teesport stand in the foreground with the hills around Eston Moor behind.

Just to the north (outside the right hand side of the photograph) is Hartlepool Nuclear Power Station.

The viewpoint was selected to be representative of views from the Heritage Coast on the southern side of the Tees Estuary.

10.6 Potential impacts

10.6.1 Construction

Throughout the 32 months of the construction period the proposed site will have the appearance of a typical construction site. The construction site will be screened to an extent by the existing plant helping to reduce the impact felt by local residents. The principal landscape and visual impacts associated with the construction phases will include:

- Landscape and visual impact associated with temporary site compounds, including temporary lighting, fencing and temporary buildings and structures;
- Storage of materials (lay down areas) and other plant and machinery;
- Site clearance including land associated with the proposed development site and other temporary site compounds;
- Temporary plant such as cranes and vehicle movements associated with site construction; and
- Demolition of the existing stele storage area in the eastern area of the site.

10.6.2 Operation

The structure and operation of the proposed plant are described in detail in Section 4.

The proposed development site will result in the loss of approximately 14 ha of currently undeveloped land. This land currently comprises a mix of rough grassland and hardstanding. The proposed layout of the plant is shown in Figure 4.3.

The main plant on site is comprised of the boiler house and steam turbine building capable of producing 300 MW of renewable electricity and associated wood chip storage area. The main plant will be orientated north-south and located in the western side of the project site with the wood storage areas located to in the east of the site near the existing Teesport dock.

The composition and size of the proposed plant is summarized below:

TABLE 10.10
PLANT DIMENSIONS
(m)

Building or external plant item	Length	Width	Height
Turbine house	57	25	35
Electrical control room	25	15	21
CFB boiler house	45	45	55
Fabric filters	26	40	25
Air cooled condenser	75	65	40
Fin fan cooler	45	23	6
Substation	20	20	5
Demineralization water building	16	15	8
Air compressor building	8	15	5
Fire fighting pump building	14	8	5
Workshop and store building	40	20	12
Office administration building	7	23	5
Covered fuel store 1	284	65	20
Covered fuel store 2 & 3	235	65	20

Building or external plant item	Height	Diameter
CFB exhaust stack	95	5.1
Fly ash silos	20	12
Bottom ash silos	20	18
Demineralized water storage tank	11	11
Fire fighting water storage tank	19	18
Low sulphur distillate fuel oil storage tanks	4	6

The buildings and plant will be of a modern and functional design and will be industrial in character and appearance. The structure will have a relatively simple clear outline, with the use of cladding and materials with finishes in recessive colours to help reduce visual impacts.

The main impacts associated with the operation of the proposed renewable energy plant will be:

- Permanent daytime visual impacts associated with the proposed power station which will introduce new, industrial plant to the locality;
- Permanent night time visual impacts associated with lighting for the new power station;
- New perimeter fencing and internal access roads;

- Change of land use from the current undeveloped use; and
- Loss of existing landscape features associated with the proposed development site.

10.7 Assessment of impacts

This section discusses the potential impacts of the proposed renewable energy plant.

10.7.1 Assessment of landscape impact

This section examines the significance of landscape effects arising from the proposed development. The significance of the landscape effects due to a development may be considered to reflect the extent to which the proposal is compatible with the character and perceived quality of the local landscape. A range of factors including the scale of the local landform, the pattern of landscape features and general sensitivity of the landscape in relation to the scale and layout of the proposed plant will influence the degree of compatibility.

The assessment considers the potential effects of the proposal on:

- The landscape fabric of the site
- The landscape character of landscape types within the study area
- The landscape designations within the study area.

Accordingly the assessment considers the baseline characteristics of each landscape type/ designated area, the extent of predicted visibility, magnitude of change and the effect of the development on landscape character.

10.7.1.1 Potential effects on landscape fabric

Changes to landscape fabric occur only within the application boundary of a site where there would be direct and indirect physical change to the landscape. There would be a permanent change to the site itself through the increase in the site elevation by about 1 m raising the site from 5 m AOD to 6 m AOD. During the construction phase there will be other temporary effects on the landscape fabric of the site as the result of ground disturbance.

During the operational life of the development there will be long term but reversible effects on the landscape fabric of the site which is in any case industrial in nature.

Landscape sensitivity

Due to its industrial nature the site is considered to have a ***low*** landscape sensitivity.

Magnitude of change

The magnitude of change to the landscape fabric would be ***negligible***.

Impact

It can therefore be concluded that the impact to landscape fabric would be ***minor***.

10.7.1.2 Effects on landscape character types

In 'The Character of England', Natural England describes the area in which the plant is located as extensively "urban and industrial" in nature.

The proposal would essentially introduce a new 55m high boiler with a 95 m stack and 40 m high ACC to the landscape that would be visible over limited areas of the surrounding terrain.

The site has a significant degree of visual containment thanks to the built up nature of the surrounding area which helps to reduce to impact on the wider landscape.

Landscape sensitivity

Due to its industrial nature the area the Tees Lowlands is considered to have a ***low*** landscape sensitivity with the impacts of additional industrial development unlikely to significantly effect the existing baseline.

Magnitude of change

The magnitude of change to the landscape character would be ***negligible*** as the plant would barely be visible from the majority of the area save the 95 m stack.

Impact

Given that the area has a low sensitivity to change and the effect of the introduction of the plant to the landscape would be negligible it can be concluded that the impact to landscape character would be ***minor***.

10.7.1.3 Other impacts

Non-visual characteristics of a development can also affect people's perception of a landscape, however, in this case, there will be no odour associated with the plant and no visible emissions from the stack or cooling system during normal operation.

10.7.1.4 Summary of landscape effects

The overall impact of the proposed development on local landscape character is, therefore considered to be slight adverse or neutral.

10.7.2 Visual impacts

The proposed plant would increase the extent of industrial development, but would not introduce new features or be of a scale which could be considered to be out of keeping with existing development around the site.

Viewpoint 1

The photomontage included in Figure 10.3 shows the view from a location near Easton Beacon. The proposed plant can be seen in the centre of the photomontage but does not significantly alter views from the location. Due to the elevated nature of the site it is possible to see the boiler house and air cooled condensers of the plant as well as the 95 m stack.

The plant is barely noticeable against the wider industrial setting of the Tees Estuary.

Receptor sensitivity

The receptor is considered to have a ***Medium*** sensitivity given its designation as a Special Landscape Area/Area of Historic Landscape Importance.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible*** given the nature of the existing views which are already dominated by the industrial setting of the Tees Estuary.

Impact

It can be concluded, given the small change to the existing views from the Eston Beacon viewpoint that the impact to receptor would be ***Minor*** and ***not significant.***

Viewpoint 2

The photomontage included in Figure 10.4 shows the view from Paddy's Hole near the Marine Club. The proposed plant is barely visible from the viewpoint. Only the 95 m stack can be seen on the horizon behind a number of other industrial features in the landscape.

Receptor sensitivity

The receptor is considered to have a ***Medium*** sensitivity due to its designation as a Special Landscape Area.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible*** as only the 95 m stack would be visible from the viewpoint and even then would be relatively difficult to distinguish from the many existing stack and other industrial features contained within the landscape.

Impact

Given that the plant would barely be visible it can be concluded that the impact to receptor would be ***Minor*** and ***not significant.***

Viewpoint 3

The photomontage included in Figure 10.5 shows the view from Southgate Eston, just to the north of the A 174. Fro the viewpoint the 95 m stack, air cooled condenser and boiler house can be seen however the plant is easily lost in the wider industrial landscape.

Receptor sensitivity

The receptor is considered to have a ***Low*** sensitivity due to its already industrial setting.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible*** due to the existing industrial setting in the backdrop of the picture***.***

Impact

It is considered that the impact to receptor would be ***Minor*** and ***not significant***.

Viewpoint 4

The photomontage included in Figure 10.6 shows the view from Smith's Dock Road. The proposed plant can be seen in the centre of the photomontage. The stack is located to the left of centre with the 55 m boiler house in the centre behind the storage tanks of the Sabic site and the 40 m air cooled condensers to the right.

As with the other viewpoints the plant is consistent with the already industrial setting of the wider area.

Receptor sensitivity

The receptor is considered to have a ***Low*** sensitivity due to the existing industrial setting.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible.***

Impact

Given the industrial setting of the site it can be concluded that the impact to receptor would be ***Minor*** and ***not significant***.

Viewpoint 5

The photomontage included in Figure 10.7 shows the view from the Riverside Stadium. Only the plant's 95 m stack is visible from this location, just behind the storage tanks in the foreground (centre left of the photomontage). Given the great number of existing stack and man made features in the landscape however it is considered that the plant would be relatively unnoticed.

Receptor sensitivity

The receptor is considered to have a ***Low*** sensitivity as the area is surrounded by industrial development to the north and east and by busy roads to the south and west.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible*** as the plant will barely be visible from the location.

Impact

It can be concluded that the impact to receptor would be ***Minor*** and ***not significant*** given the visibility of the plant will be minimal from this location.

Viewpoint 6

The photomontage included in Figure 10.8 shows the view from Port Clarence on the north side of the River Tees. The plant can be seen in the centre left of the photomontage with the stack on the left and the top of the boiler house to the right, just behind a couple of existing stack at on the two Billingham refineries.

Receptor sensitivity

The receptor is considered to have a ***Low*** sensitivity as it holds no local or national designation and has existing views of the Billingham industrial area.

Magnitude of change

As the plant would be only partially visible in the distance magnitude of change to the existing view would be ***Negligible.***

Impact

Given the distance to the plant and the industrial nature of the landscape on the horizon the impact to receptor would be ***Minor*** and ***not significant***.

Viewpoint 7

The photomontage included in Figure 10.9 shows the view from Old Greatham Bridge where the A178 crosses the Greatham Creek. The plant can just be seen in the centre of the photomontage but is almost entirely obscured by the refineries on the Billingham side of the River Tees.

Receptor sensitivity

The receptor is considered to have a ***Low*** sensitivity due to its industrial setting.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible.***

Impact

It can therefore be concluded that the impact to receptor would be ***Minor*** and ***not significant***.

Viewpoint 8

The photomontage included in Figure 10.10 shows the view from the Teesmouth National Nature Reserve. The plant can be seen in the centre of the site with all but the 95 m stack and the 55 m boiler house being obscured by other industrial plant in the foreground. The plant can be seen as being consistent with the industrial setting of the area.

Receptor sensitivity

The receptor is considered to have a ***Medium*** sensitivity given its status as a National Nature Reserve and as an area used by members of the general public for recreational purposes.

Magnitude of change

The magnitude of change to the existing view would be ***Negligible*** due to the separation distance from the site and the existing developments that serve to mask views of the REP***.***

Impact

It can be concluded that the impact to receptor would be ***Minor*** and ***not significant***.

TABLE 10.11
SUMMARY OF VISUAL IMPACT ASSESSMENT FROM ILLUSTRATIVE VIEWPOINTS

No.	Location	Comments	Sensitivity of visual receptor	Visual impact assessment
1	Ledge Near Eston Beacon	**Special landscape area/area of historic landscape importance/recreational area**	Medium	Minor
2	Paddy's Hole – South Gare Breakwater	**Special landscape area**	Medium	Minor
3	Southgate Eston	**Residential**	Low	Minor
4	Smith's Dock Road	**Road users**	Low	Minor
5	Footbridge Riverside Stadium	**Recreational (Middlesbrough football club)**	Low	Minor
6	Port Clarence	**Residential**	Low	Minor
7	Old Greatham Bridge – A178 Tees Road	**Road users/recreational (rspb planned reserve)**	Low	Minor
8	Teesmouth National Nature Reserve	**Recreational (beach users/nature reserve visitors)**	Medium	Minor

10.7.2.1 Plume visibility

Due to the nature of the clean wood chip fuel which has a high water content there will, under some weather conditions, be a visible plume from the stack that will be visible over a wider area. This is as a result of the evaporation of the moisture contained in the wood chip fuel during the combustion process which on exiting the stack can condense rapidly depending on temperature of the air and the ambient relative humidity.

The plume will be clean/white in appearance with the plume visibility modelling discussed further in Section 6 suggesting that the length will not exceed 550 m with a length of 110 m being mode typical when the plume is visible at all. For the majority of the year, about 83 per cent of the time, there would be no visible plume at all, with most of the visibility occurances expected during night time.

10.7.2.2 Summary of visual impacts

Due to the heavily industrialized nature of the landscape in the Teesside area the impact resulting from the proposed renewable energy plant will be negligible. In the few areas where views of the

plant are easily achieved the project will fit in well with the industrial nature of the landscape. From the majority of the surrounding area the plant will not be visible however, obscured from view by exiting development, both industrial and residential.

The plant will on occasion give rise to a visible white plume but this will not be the case for the great majority of the year.

10.8 Mitigation

10.8.1 Construction

A Construction Management Plan would be prepared in support of the proposed site development. The Construction Management Plan will address the following:

- Temporary storage of topsoil and any other material considered of value for retention;
- Wheel washing facilities and soil dampening will ensure that debris and soils do not escape to the surrounding environment;
- Design and layout of site construction areas including the location and type of temporary security fencing and lighting.

10.8.2 Operation

The key mitigation measure has been the location of the plant within an industrial setting. In doing so the need for extensive works on water pipelines and transmission lines has been minimized. Other mitigations measures proposed include the below.

The architectural design of the plant will be sensitive to the suggestions of local planning officers.

The architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints.

The external structures of the buildings will be designed such that there will be no deterioration in the power station's appearance over the 25 years lifetime of the plant.

A limited combination of materials will be used in the construction of the external structures to give a cohesive appearance to the plant. Colour coated profiled aluminium sheeting will be used on upper levels and facing brickwork or dense concrete masonry will be used, where appropriate, at lower levels including low level buildings. A recessive colour scheme will be used in order to break up the impact of the built structures as shown on the photomontages. The final colour scheme will be agreed with Redcar and Cleveland Council.

The renewable energy development will include the following lighting systems: site lighting and emergency lighting, road lighting and area floodlighting. Lighting systems and design will be similar to those used on the various surrounding sites. Lighting systems will comply with current best practice and industry standards in order to minimize light spread and glare off site.

Ways of introducing planting, perhaps as part of an ecological mitigation scheme will be investigated.

10.9 Assessment of cumulative effects

The assessment above considers the impacts associated with the construction of plant in the context of the existing site conditions. At the time of writing there are a number of other applications either under consideration by RCBC or pending.

It is not considered that any of these applications have the potential to give rise to any significant cumulative impacts in conjunction with the proposed renewable energy plant due to distance and the industrial nature of the surrounding area.

10.10 Conclusion

The substantial buildings envisaged on site are the boiler house, stack, air cooled condenser, control room and storage tanks. The remaining plant and equipment will, in the main, be housed in relatively low buildings, of the order of 3 to 6 m in height. The tallest structure on site will be the 95 m stack.

It is considered that the locating of the plant in an industrial area designated for industrial development respects the general aims of the local authorities. The plant is located in an area that has reduced the need for extensive works on water pipelines and transmission lines that would impact further on the landscape.

The change to the existing baseline is not considered to be significant given the proposed location of the plant.

11. TRANSPORT AND INFRASTRUCTURE

11.1 Summary

This section presents the findings of the assessment of the impact on local traffic and infrastructure of the proposed Tees Renewable Energy Plant (Tees REP). Details of the assessment methodology and significance criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

The 32 month construction period for the proposed Tees REP will give rise to additional transport movement on the local transport network. All vehicle movements relating to the proposed development will be required to travel along the A1053 Tees Dock Road.

A green travel plan will be agreed with the local highways officer prior to the commencement of the construction phase to help mitigate the potential impact of the proposed works to local and regional traffic and infrastructure.

In addition to the estimated 250 staff transport movements, construction traffic will consist of civil works traffic, mechanical works traffic and a small number of abnormal loads for components such as the steam turbines. Approximately 45 heavy commercial two way vehicles movements per day will be expected on average, deliveries will be spread throughout the day, at a maximum rate of around 5 per hour.

The number of abnormal loads is likely to be of the order of 5 over the 32 month construction period. The transport of abnormal loads, which may lead to delays and cause inconvenience to other road users, would be timed following consultation with the relevant authorities to minimize disruption to the other road users.

Operation of the proposed plant will naturally result in much fewer traffic movements than those associated with construction, of the order of 150 two-way vehicle movements per day. A large proportion of these vehicle movements (approximately 120 vehicles) will be due to the 150 staff operating the plant and the majority of the journeys will therefore be local.

The delivery of the biomass fuel to site will be almost entirely sea to the deep water quay that serves the site and will have no effect on the local infrastructure. Ash produced by the process will be removed from site by approximately one covered truck per hour. This equates to 9 two way vehicle movements per day.

MGT Teesside Limited (MGT) anticipates that locally farmed energy crop biomass may be brought to site by road. This would be delivered in 30 tonne HGVs, which would result in up to 18 two-way vehicle movements per day. MGT will endeavour to use the HGV trucks used to deliver the biomass to transport the ash produced by the plant, thereby reducing incremental traffic impact by up to 33 per cent. These vehicle movements would be strictly kept to off peak hours and in any case will not exceed a level deemed appropriate for the local road infrastructure.

The cumulative impact on the local traffic network of the renewable energy plant requirement for the delivery of abnormal loads and the road improvement schemes proposed as part of the Northern

Gateway development is considered to be moderate. The majority of the impact however is associated with the Northern Gateway development . To help reduce this impact MGT proposes that the Northern Gateway group, the council and MGT discuss the implementation of a joint travel plan for the two developments.

The total impact on traffic and infrastructure is not considered to be significant.

11.2 Introduction

This section presents the findings of the assessment of the Traffic and Infrastructure impact of the proposed Tees REP. Details of the assessment methodology and significance criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

Cumulative impacts of the plant and other developments in the vicinity are also considered.

11.2.1 Assessment methodology

This transport assessment has been undertaking in accordance with the Department for Transports Guidance on Transport Assessment (March 2007).

It is anticipated that the construction period for the proposed Tees REP would last for 32 months, commencing in 2009. The construction workforce is expected to peak at around 600.

The plant will require approximately 150 staff to satisfy the daily operational and maintenance requirements. Traffic associated with the operation of the plant would be of the order of 150 two way vehicle movements per day. A large proportion of these (approximately 120 vehicle movements) will be due to staff movements and will, therefore, be predominantly local journeys.

In order to understand the context and scale of the implications on local transport, the baseline conditions have been determined through a desk study of current transport data and details of the local infrastructure, specifically the A1053 Tees Dock Road serving the site, the A174, between Thornaby on Tees and Lazenby, and the A66, between Grangetown and the A19 west of Middlesbrough.

11.2.2 Significance criteria

The significance criteria of the impacts on the existing transport structure are defined as:

- Major: High, lasting, disruption requiring extensive mitigation;
- Moderate: Moderate disruption requiring mitigation;
- Minor: Exceeds existing thresholds but causes no disruption;
- Insignificant: No perceived impact.

11.3 Baseline conditions and receptors

The local road network in the vicinity of the site can be seen in Figure 1.1. The major road links in the area are the A66 that runs east/west approximately 2.5 km south of the site, east of Middlesbrough, and the A174 that runs west from around 5 km approximately south-east of the site. The A66 is mainly a two- and three-lane dual carriageway that intersects with the A19 west of Middlesbrough and, beyond Darlington, becomes a motorway for around 3 km before joining the A1 (M). The A174 is a dual carriageway that runs from Thornaby on Tees to Whitby. The road is of trunk road standard between the A19 and Greystones Roundabout.

Within the study area, the A66 passes under the jurisdiction of Middlesbrough Borough Council, between the A19 and the junction with the A171 Cargo Fleet Road, and Redcar and Cleveland Borough Council, east of this junction and on to Grangetown.

The A174 north-west of Hemlington has experienced nearly a 50 per cent increase in traffic volume since 2000, the most significant in the study area. However, the increase is predominantly due to a dramatic increase in 2001 of 35 per cent on the previous year. Since then traffic growth levels have remained at around 3 per cent per year to the current daily average of around 40 000. The busiest section of the road is by the junction with the A19 with an average daily estimate of almost 54 000.

The section of the A66 that passes north of Middlesbrough, to the A19, has more than double the daily traffic volume of the remainder of the road, at one point reaching an annual average daily traffic count of almost 79 000. There was, almost, a 43 per cent increase in traffic flow between 2000 and 2006. Between the junction with Cargo Fleet Road and Grangetown the A66 experienced only a 7 per cent increase.

Access to the site is provided by the A1053 Tees Dock Road that connects to the end of the A66 north of Grangetown. Between 2000 and 2006, the road experienced a 17 per cent decrease in traffic flow with the average daily traffic count recorded being approximately 4700.

Almost 9 per cent of the working population use public transport to travel to work despite access to the site via public transport being poor. Bus route 64, serving Middlesbrough and Redcar provides the best link to site of the current network however the nearest bus stop is approximately 3.5 km to the south of the site (by road), on the eastern exit to the A1053/A1085 junction. The nearest railway station is South Bank on the Tees Valley railway line that runs between Saltburn and Bishop Auckland. The station, around 5.5 km south-west of the site, is unmanned and trains only stop twice in the morning and twice in the early evening.

The consequence of the limited provision of public transport is that private vehicle usage is high in the region. The majority of people, 74 per cent, travel to work by private transport over an average distance of approximately 11 km.

The site is served by a dedicated freight railway and includes a disused deep water quay.

The location of the proposed facility is remote in terms of neighbouring residential areas and, as such, there is limited scope for walking to work. Although cycling to work is limited for most residential

areas there could still be a opportunity for residential areas in Greater Eston giving the proximity to the site.

11.4 Potential impacts

11.4.1 Construction

At the height of the construction phase, the on-site workforce will be of the order of 600. Car sharing and the use of minibuses, by the construction contractors, will be encouraged. It is anticipated that there will be approximately 250 vehicles transporting staff to and from the site per day.

Construction work will only take place during daylight hours and will be limited to:

Monday to Friday	07:00 – 19:00 hours
Saturday	07:00 – 17:00 hours.

Therefore, the bulk of the workforce traffic to and from the site will occur between the hours of 06:00 – 07:00 and 19:00 – 20:00 and outside of the peak hours for the local road network. As such, the impact of construction staff traffic is considered to be insignificant.

In addition, construction traffic consisting of commercial vehicles delivering civil and mechanical works machinery will travel to and from the site. Materials used during the civil works will include ready-mixed concrete and/or raw materials for the on-site manufacture of concrete, reinforcing bars, structural steelwork, cladding and road materials. The items of plant machinery will be delivered to the site for the mechanical works. On average, approximately 45 heavy commercial two way vehicle movements and 15 light commercial two way vehicle movements will be expected to visit the site each day. Deliveries will be spread throughout the day, at a maximum rate of around 5 per hour, a level that is considered to be insignificant.

The number of abnormal loads that would be required will be of the order of 5 over the 32 month construction period. The exact number will depend on the final configuration of the plant and will be defined upon completion of the tendering process. The transport of abnormal loads can lead to disruption or delays and is considered to be of moderate significance.

11.4.2 Operation

Operation of the proposed plant will naturally result in much fewer traffic movements than those associated with construction, of the order of 150 two way vehicle movements per day. A large proportion of these vehicle movements (approximately 120 vehicles) will be due to the 150 staff operating the plant and the majority of the journeys will therefore be local.

During operation it is expected that the plant will run under a five shift system, a typical example of such a system is shown in Table 11.1.

TABLE 11.1
CONTINUOUS 5-SHIFT SYSTEM

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	M1	M1	N1	N1			
2	A	A	A		M1	M1	M2
3	N1	N1					
4			M1	M1	N1	N1	N2
5				A	A	A	
Total cover	MAN	MAN	MAN	MAN	MAN	MAN	M2N2

M1 = Morning shift (8 hours) M2 = Morning shift (12 hours) N1 = Night shift (8 hours)
N2 = Night shift (12 hours) A = Afternoon shift = day off

The maximum number of staff on-site at any one time will be around 30 during the morning and afternoon shifts. The number of staff onsite during the night shift will reduce to approximately 20 personnel. It is expected that a maximum of around 24 to 30 vehicles would arrive or depart the site at any one time during shift changes.

The delivery of the biomass fuel to site will be almost entirely by sea to the deep water quay that serves the site and will have no effect on the local infrastructure. The fuel will be offloaded directly at the quayside and transferred to the fuel storage and preparation areas. Ash produced by the process will be removed from site by approximately one covered truck per hour. This equates to 9 two way vehicle movements per day.

MGT hopes that a market will emerge for locally farmed energy crop biomass as a result of the construction of the plant. It is anticipated that locally farmed energy crop biomass may be brought to site by road. This would be delivered in 30 tonne HGVs, which would result in up to 18 two way vehicle movements per day. It is thought the HGV trucks used to deliver the biomass could also be used to transport the ash produced by the plant, thereby reducing incremental traffic impact by up to 33 per cent. These vehicle movements would be strictly kept to off peak hours and in any case will not exceed a level deemed appropriate for the local road infrastructure..

All vehicle movements relating to the proposed development will be required to travel along the A1053 Tees Dock Road. The plant is anticipated to generate a maximum of 150 additional two way vehicle movements per day which represents an increase of around 3 per cent of the current average daily levels for the road. On the wider major road network the figure is lower, at a maximum of 2.1 per cent at all points along routes defining the study area. The impact of this additional traffic is therefore considered to be insignificant.

It may be the case that biomass material is also brought to site via the railway that links the Teesport site to the wider national rail network. In this instance biomass would be delivered infrequently,

perhaps on a daily or weekly basis and would have little to no impact on the wider rail network. The use of trains for such duties will be encouraged wherever possible to minimize the impact to the local road network.

11.5 Assessment of cumulative effects

The major, additional, consideration regarding the transport network and infrastructure is the proposal for the construction of the Northern Gateway deep water container terminal on the Teesport Estate.

The 80 week construction programme for the first phase of the terminal is anticipated to start in 2009 with commencement of operation scheduled for 2010. The forecast generation of construction traffic, as detailed in the associated Environmental Statement (ES), is around 230 cars and/or vans, plus 40 heavy goods vehicles, per day. It is anticipated that the construction of the Renewable Energy Plant will begin in 2009 for a period of around 32 months. Therefore the total traffic generated by the construction of both developments will be around 500 cars and/or vans and 90 heavy goods vehicles per day.

Heavy goods vehicles arriving and departing from site will be spread throughout the day. Car and van movements will largely reflect the start and end times of each working day. It is expected that a construction day for the Northern Gateway will be 07:30 – 18:00 and, as proposed in Section 11.5.1, will be 07:00 – 19:00 for the renewable energy plant. Assuming that staff travel through the study area over a period of an hour before starting work, the only cumulative effect of both construction programmes on the local road network will be between 06:30 and 07:00. As this is well outside of the peak morning hours for the area the impact of the construction traffic is considered to be insignificant.

The operational staff traffic volume of the renewable energy plant will be of the order of 120 vehicles per day. As the plant is expected to run under a five shift system the facility is expected to generate a maximum of around 24-30 additional vehicles on roads within the study area at any one time. This will mainly arise for an hour before and after a shift change and will predominantly consist of local journeys spread throughout the region.

In the Northern Gateway ES, operational figures for the current terminals on the Teesport Estate were used to anticipate that over 3200 heavy goods vehicles per day will be required to facilitate full operation of the new terminal.

As part of the Northern Gateway planning application mitigation measures and road improvements were discussed and agreed with the Highways Agency to help accommodate the proposed levels of traffic. Additional road network improvements have also been proposed as part of the development of the South Tees Eco-Park. Although these are concentrated on the proposed main entrance to the site via the Eston Road/A66 roundabout, there is some overlap of the two sets of improvements on the A1053 between the junction with the A66 and A174. By the time the Tees REP is expected to be in operation the improvements to the road network should have been made.

However it was noted by the Highways Agency that there would be residual adverse effects to certain junctions in the area after the proposed improvements. The significant junction within the context of the renewable energy plant development is the A1053/A1085. As part of the Northern Gateway development signalling will be introduced to the north, south and east approaches to the junction.

Residual effects of increased queuing have been predicted at this roundabout in both the morning and evening peaks. The ratio of flow to capacity is also anticipated to exceed 85 per cent for the newly signalized arms in the morning peak and for the northern approach in the evening peak.

The cumulative impact on the local traffic network of the renewable energy plant requirement for the delivery of abnormal loads and the road improvement schemes proposed as part of the Northern Gateway development is considered to be moderate. It will be necessary to discuss and plan the movements of any abnormal loads and the locations of road works, in advance, with the relevant authorities. All such discussions will, as a matter of course, take into consideration the needs of both developments and ensure the least possible cumulative impact on the local infrastructure.

11.6 Mitigation

11.6.1 Construction

A Traffic Management Plan will be developed, prior to construction, however it is anticipated that all deliveries will be brought to site via the A174, being the preferred strategic route cited by Redcar and Cleveland Borough Council, and Tees Dock Road. Materials will be delivered to site at off peak hours.

Staff traffic will have no prescribed route, and so, will be dispersed over the entire local road network. All vehicle movements will be actively managed, in full consultation with Redcar and Cleveland Borough Council to ensure that any possible inconvenience to other traffic is minimized or eliminated.

To minimize any possible cumulative impact, travel to work options will be actively promoted to the contractors workforce to reduce any conflicts with the other developments in the area that may be proceeding in the same timescale. In addition, MGT will look to integrate the Tees REP and Northern Gateway Transport Management Plans. During the preparation of the Tees REP Transport Management Plan MGT will look to hold discussions with Redcar and Cleveland Borough Council, the Highways Agency, and Northern Gateway representatives to discuss this possibility. One such mitigation measure that MGT would like to introduce in a joint Transport Management Plan is the employment of shuttle buses to service both sites during their construction

Redcar and Cleveland Borough Council have published a freight transport map that outlines the preferred routes for such traffic and additional information regarding the transport of abnormal loads in the region. While it is anticipated that all movements will follow these guidelines, the routes and timings of the transportation of abnormal loads will be discussed fully with the relevant authorities in order to minimize disruption.

Construction contractors will still be required to perform surveys to ensure that any abnormal load can be delivered to site with the least inconvenience to other road users and, if necessary, be responsible for the cost of any route strengthening requirements. The delivery of the abnormal loads to site will be coordinated with guidance from Redcar and Cleveland Borough Council. A police escort may also be used if deemed necessary.

11.6.2 Operation

No perceivable impact is expected during the operation of the proposed plant however a travel plan regarding mode share forecasts and targets will be submitted to Redcar and Cleveland Borough Council for formal acceptance.

Measures will be introduced to encourage the use of public transport wherever possible including shuttle buses operating along Tees Dock Road and around the Teesport estate. Cycling to work will also be promoted wherever possible and Tees REP will have cycling facilities for employees cycling to work.

Detailed survey work will be undertaken on an annual basis to monitor the effectiveness of the travel plan. The results and details of proposed corrective actions, where necessary, will be made available to the planning authority.

The ash produced from the process will be removed from site during off peak hours to minimize any impact on the local network. If a local supply of biomass becomes available it is thought that the HGV trucks used to deliver the biomass could also be used to transport the ash produced by the plant, thereby reducing incremental traffic impact by up to 33 per cent.

Vehicle movements involving the supply of biomass would be strictly kept to off peak hours and agreed with Redcar and Cleveland Borough Council. Night time deliveries will also be considered if thought to be beneficial by the local authority.

11.7 Conclusion

The impact of construction traffic may at times be significant but, following a process of thorough consultation and discussion with the relevant authorities, this will be actively managed to ensure that any disruptions are minimized.

During operation it is considered that the existing local road network will have sufficient capacity to accommodate this level of increase in traffic volume. This view is further justified by the improvement schemes proposed as part of the approved planning application for the Northern Gateway deep water container terminal and the development of the South Tees Eco-Park and the associated comments from the Highways Agency.

The total impact on traffic and infrastructure is considered to be insignificant.

12. SOCIO-ECONOMICS

12.1 Summary

At its peak, the construction workforce will total about 600. It is believed most of the workforce will be recruited locally. Approximately 150 staff will be required for roles and tasks associated with the daily operational and maintenance requirements of the new plant.

Total investment in the project will be of the order of over £400 million. In addition, the operational and maintenance costs of the proposed plant will be in region of £30 million per annum. In addition to the use of local services, a significant proportion of this will serve to benefit the local economy in terms of employee wages, local purchases and local capital expenditure. It is expected that annual expenditure of this level could create an additional 300-500 jobs, indirectly, in the local economy. Dock dues worth £7 million per year will also constitute an additional revue stream for the local economy.

The Tees Renewable Energy Plant (Tees REP) is considered to have a **high positive socio-economic impact**.

12.2 Introduction

This section presents the findings of the assessment of the socio-economic impact of the proposed Tees REP. Details of the assessment methodology and significant criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

Cumulative impacts of the plant and other developments in the vicinity are also considered.

12.3 Assessment methodology and significance criteria

12.3.1 Assessment methodology

In order to fully assess the impact of the proposed plant, it is necessary to fully determine the baseline conditions of the affected areas of the socio-economy.

A desk study was undertaken to establish the existing situation for the region in line with the defined significance criteria. The assessment focused on the towns of Eston, South Bank and Grangetown and Redcar and Cleveland as a whole. The likely impacts of the proposal were then considered within the context of these conditions and the appropriate local authority objectives for social and economic development.

Comparisons were also made with the present positions of the North East, and the rest of the country.

12.3.2 Significance criteria

The significance criteria of the impacts on the socio-economy are defined as:

- High: Large, or long-term, change to the socio-economy;
- Moderate: Small, or short-term, change to the socio-economy;
- Insignificant: No perceivable impact.

Impacts may also be classified as positive or negative.

12.4 Baseline conditions and receptors

The site is located on the south bank of the River Tees approximately 4 km north east of Middlesbrough, North Yorkshire. The local population is approximately 21 500 with the population of Redcar and Cleveland as a whole standing at around 139 500. South Bank, part of the conurbation of Middlesbrough, is the administrative centre of Redcar and Cleveland.

Table 12.1, based on information from the Office of National Statistics, shows the sector breakdown of the working population of Redcar and Cleveland, compared with regional and national details.

TABLE 12.1
EMPLOYEES IN EMPLOYMENT

	Redcar and Cleveland (%)	North East (%)	England (%)
Agriculture and Fishing	1.0	1.2	1.5
Energy and Water	2.8	1.6	1.0
Manufacturing	18.8	17.0	14.8
Construction	8.4	7.3	6.8
Distribution, Hotels and Restaurants	20.9	21.3	21.6
Transport and Communications	6.1	6.8	7.1
Banking, Finance and Insurance	11.3	12.2	18.0
Public Administration, Education and Health	26.4	28.2	24.1
Other Services	4.3	4.5	5.2

The employment patterns in Redcar and Cleveland are generally similar to that of the North East. The South Tees Employment Area that runs along the south bank of the river has been built up around the iron, steel and ship building industries and is highlighted by employment figures for manufacturing and construction. The decline of these industries in recent years has subjected the area to significant economic deterioration in comparison to the rest of the country. Recent developments by the chemical and energy industries have seen investment in the area stabilize however problems regarding population decline and unemployment remain.

Unemployment rates for the local area and Redcar and Cleveland are higher than the national figure of 5.8 per cent based on Census data from 2001. The Office of National Statistics recorded an unemployment rate, in the area, of 13.9 per cent for that year compared with the Redcar and Cleveland Council recorded rate of 9.8 per cent.

Car ownership in the area is low with nearly 50 per cent of households owning no car or van. This compares poorly to 32 per cent for Redcar and Cleveland and 27 per cent nationally. However, the average distance travelled to work by the economically active people of the local area is 11 km, compared with 13 km for Redcar and Cleveland and 12 km for the North East.

Of the population in Redcar and Cleveland, the proportion of people with no, or an unknown level of, qualifications is comparable with that of Great Britain, 15 per cent and 14 per cent respectively. The level of those educated beyond A-Level standard is also equivalent to that of Great Britain, 41 per cent compared to 45 per cent.

12.5 Potential impacts

12.5.1 Construction

At the peak of the construction phase, the plant will employ of the order of 600 construction staff, of which up to 50 to 60 per cent could be recruited from local residents. The construction period will be approximately 32 months in duration and will provide a tangible amount of work for local contractors. Works machinery will be required for all aspects of the development and may be sourced from local plant hire companies.

The civil works that will constitute the initial stages of the construction will require a small unskilled workforce. The subsequent mechanical and electrical works will utilize a larger workforce with more specialized skills.

The job opportunities specifically created by the project are known as the direct job opportunities. A breakdown of the likely direct job opportunities resulting from the construction of the plant are shown in Table 12.2.

TABLE 12.2
DIRECT JOB OPPORTUNITIES ASSOCIATED WITH PLANT CONSTRUCTION

Operation	Role	Skill set/qualification	Number of employees
Power Plant	Civil engineers	Degree	20
	Mechanical engineers	Degree	20
	Electrical engineers	Degree	20
	Other engineers	Degree	35
	Labourers	Unskilled	295
	Semi skilled workers	HND/HNC	180
	Administrative services	Unskilled	30

Workers from outside the area are likely to commute, weekly, to the site. The temporary accommodation requirements will be provided by local hotels and guesthouses, or privately, generating more business in this sector of the local economy, and increasing spending in the area. Construction staff typically comprise of a high proportion of single males who make relatively low demands on education, health and recreational facilities. In the event that large numbers of the workforce are recruited from outside the area, it is anticipated that no significant impact will be made on such services.

The money invested into the local economy, in terms of construction staff wages and project expenditure on local goods, services and contractors, will generate further economic activity and indirect employment benefits. The indirect employment opportunities are generated by activities related to the project itself and necessary to its success such as the supply of raw materials and equipment. A breakdown of the indirect jobs opportunities likely to be created from the construction of the plant are shown in Table 12.3.

TABLE 12.3
INDIRECT JOBS OPPORTUNITIES ASSOCIATED WITH PLANT CONSTRUCTION

Operation	Role	Skill set/qualification
Power Plant	Cleaning	Unskilled
	Landscaping	Unskilled
	Waste disposal	HND/HNC
Transport	Transport of raw materials	Unskilled/ HGV driving licence
	Transport of staff to site	Unskilled/ Minibus driving licence
Manufacturing	Equipment eg tools, cement etc	Unskilled/HND/HNC
Catering	Food preparation	GNVQ/HND

The manufacturing and construction industries form a significant part, over 27 per cent, of the local employment landscape. Local contractors will be encouraged to tender for construction works packages. In support of this, MGT has established a web-based register for interested companies and individuals. MGT will host seminars for local businesses to assist in the identification of supply and support opportunities during the construction of the REP.

Throughout the construction, every effort will be made to ensure as much of the investment as possible remains in the region.

All construction activities will be carried out under the provisions of the Construction (Design and Management) Regulations 2007.

12.5.2 Operation

Approximately 150 staff will be required for roles and tasks associated with the daily operational and maintenance requirements of the new plant. These jobs will be permanent, non-seasonal, and will exist for over 25 years of operational lifetime of the plant.

Skilled and semi-skilled operators will make up approximately 95 per cent of the operational workforce. Such staff will have a background appropriate to their discipline and will receive additional training relating to power plant operation. The knowledge of the manufacturer will be transferred to the operating staff during the commissioning phase of the development by ensuring full and active participation in the trials and testing of the plant equipment. Staff at all levels will receive training on process and emission control and regular appraisals will be made of all training requirements. The plant will be operated in accordance with the manufacturer instructions.

MGT will look to employ as many skilled operators from the local area as possible. In partnership with local training agencies, MGT will look to provide local training for applicant/employees in the area. The training courses will give local applicants/employees the necessary skills required for the job opportunities available once the plant is in full operation. A breakdown of the likely direct jobs opportunities available once the plant is in operation are shown in Table 12.4.

TABLE 12.4
DIRECTS JOBS OPPORTUNITIES ASSOCIATED WITH PLANT OPERATION

Operation	Role	Skills set/qualifications	Number of employees
Jetty	Jetty Operator	Unskilled	5
Fuel store area	Outlayer operator	Unskilled	5
	Return operator	Unskilled	5
	Processing operator	Unskilled	5
	Shovel operators	Unskilled	5
Conveyor	Conveyor operators	Unskilled	5

Operation	Role	Skills set/qualifications	Number of employees
Power Plant	Manager	Degree	1
	Shift leaders	Degree/HNC	5
	Mechanical engineer	Degree	3
	Electrical engineer	Degree	3
	Other engineers	Degree	10
	Control room staff	HND/HNC	25
	Administration	Unskilled	12
	Accountant	Degree	1
	Cleaners	Unskilled	20
Maintenance	Maintenance personnel	Semi-skilled	40

It is anticipated that the operational staff will work on a five-shift system, with 30 workers per shift and a maximum of 60 staff on-site where shifts overlap.

As part of the plant operation and maintenance regime, permanent staff will be responsible for the management of sub-contractors. Local companies will be approached to provide skilled and semi skilled services and it is estimated that a further 25 direct jobs may be created, on the basis of the levels of permanent staff in these local service industries. Typical requirements would include security, general maintenance and catering.

The operational and maintenance costs of the proposed REP will be in region of £30 million per annum. In addition to the use of local services, a significant proportion of this will serve to benefit the local economy in terms of employee wages, local purchases and local capital expenditure. It is expected that annual expenditure of this level could create an additional 300-500 jobs, indirectly, in the local economy. A breakdown of the likely indirect jobs opportunities available once the plant is in operation are shown in Table 12.5.

TABLE 12.5
INDIRECT JOBS OPPORTUNITIES ASSOCIATED WITH PLANT OPERATION

Operation	Role	Skills set/qualifications
Power Plant	Waste Disposal	HND/HNC
Transport	Transport of fuel to site	Unskilled/ HGV driving licence
	Transport of staff to site	Unskilled/ Minibus driving licence
Maintenance	Maintenance personnel	Semi skilled

It is MGT's hope that a market will emerge for locally farmed energy crop biomass as a result of the construction of the plant. MGT anticipates that locally farmed energy crop biomass may ultimately provide of the order of 200 000 tonnes per annum. The cost of the biomass can be expected to be £80 per ton (at current market rates), therefore sourcing the biomass fuel locally will lead to a positive contribution in the region's economy of circa £16 million. MGT will actively seek locally farmed energy crop wherever practical and will look to hold discussions with local farmers to discuss this possibility.

The Redcar and Cleveland Core Strategy Development Plan Document published in July 2007 expresses concern regarding the disparity of employment and income levels between different areas of the borough. In addition to the ongoing financial contribution that the proposed project would provide to the region, MGT will consult with, and support, local communities and are committed to maximizing local benefits, wherever possible.

The plant will be viewed within the context of the existing industrial landscape of the South Tees Employment Area. There are no Public Rights of Way in the vicinity of the proposed site. It is, therefore, not considered that the extension will cause any impact on the view of the area and be insignificant to the area's income from tourism.

There will be no unacceptable risk to public safety in the vicinity of the plant or any adverse effect on existing, or allocated, land uses in the area. The proposed plant will not conflict with users of neighbouring land.

12.6 Mitigation

12.6.1 Construction

The construction of the proposed development will provide jobs for the region and, directly and indirectly, bring more money into the local economy.

No mitigation measure or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of the plant, during construction.

12.6.2 Operation

Operation of the plant will create permanent employment opportunities and establish strong local service links, spending £30 million each year, most of which will benefit local industry and services, for the lifetime of the plant. It is expected that annual expenditure of this level could create an additional 500 jobs, indirectly, in the local economy. There are no negative impacts expected of the power station on any other aspect of the socio-economy of Redcar and Cleveland.

No mitigation measure or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of plant, during operation.

12.7 Assessment of residual effects

12.7.1 Construction

Local residents will, potentially, form a significant part of the construction workforce. Where this is not possible, the typical contractor demographic will mean that the demands made, by workers from outside the area, on local public services such as health or education will be insignificant.

There will be a moderate positive impact of local businesses. Wherever practical, as much of the project cost of £400 million will be invested within the region. Various local companies, such as Foster Wheeler, PX Power, AKER Kvearner, AMEC and smaller NEPIC members stand to benefit.

There will be a moderate positive socio-economic impact from the construction of the plant.

12.7.2 Operation

Operation of the proposed plant will provide around 150 permanent, non-seasonal, jobs for the area. The estimated operational and maintenance costs of the plant will be of the order of £30 million and will benefit the local economy in terms of local capital and service expenditure, creating additional job amongst local businesses. Dock dues worth £7 million per year will also constitute an additional revue stream for the local economy.

The presence of the plant will produce a high positive socio-economic impact helped by the provision of development opportunities for local peoples, and the economy as a whole. It is expected that annual expenditure of this level could create an additional 500 jobs, indirectly, in the local economy.

12.8 Conclusion

The proposed power station will have a high positive socio-economic impact. The large capital investment in the project will be passed, as far as is practicable, to the local economy. A high volume of jobs will be created during the construction phase and during operation a lower number of, yet longer term, opportunities will be established during operation. Local companies will be approached to provide mainly unskilled and semi-skilled services and presents the possibility for additional job creation.

There are no negative socio-economic impacts associated with the proposed development.

13. ECOLOGY

13.1 Summary

An ecological impact assessment of the proposed Tees Renewable Energy Plant (Tees REP) development site has been undertaken comprising a detailed desk study, consultation and field studies, including reptile survey.

The Tees estuary is situated immediately north and east of the proposed development site, which is located on land adjacent to the main southern dock at Teesport on the south bank of the Tees. Further east, an area of land is being developed into the Northern Gateway Container Terminal. Situated to the south and west of the proposed development site is predominately industrial or previously industrial land with areas of wasteland and major roads. These features can be clearly seen in the photograph at Figure 13.1.

The proposed development site comprises hard standing and buildings interspersed with semi-improved grassland and areas of occasional scrub and ruderal vegetation. A culvert for a drainage stream of poor quality is situated to the south of the proposed development site boundary; the stream remerges into the Tees outside of the northern boundary.

There is one internationally designated site, Teesmouth and Cleveland Coast Ramsar site and Special Protection Area (SPA), and eight nationally designated sites site of nature conservation importance within 10 km of the proposed development site. The nearest SSSI also forms part of the SPA, approximately 1.5 km to the south-west. Neither the designated sites nor their associated species are considered to be significantly impacted upon by the proposed development.

Bran Sands and Vopak Foreshore, habitats of local (non-designated) importance are located within approximately 1.5 km and 0.75 km (respectively) of the proposed development site and are used by protected and notable bird species associated with the surrounding designated sites. No significant direct impacts on these sites or associated species are expected as part of the construction and operational phases. Designed-in mitigation for low-level drainage into the Tees will render a potentially negative indirect impact of low magnitude as insignificant throughout the period of the proposed development's lifespan.

A dedicated survey carried out under guideline conditions did not record the presence of reptiles or amphibians. Other protected species potential in the immediate area was limited to the presence of terrestrial bird species that may utilize the scrub habitats and buildings on site for breeding. Where potential exists for terrestrial breeding birds (scrub vegetation and buildings), removal or demolition will be undertaken outside the bird breeding season (March to late September inclusive for the majority of species) or alternatively, an ecologist will supervise the works. With these procedures being followed the potential impacts upon birds are considered negligible.

Through the selection of air cooled condensers as a cooling method Tees REP completely avoids the issues of thermal discharge and abstraction of significant quantities of river water; these are typically major impacts a thermal power plant can have on the local water resources and associated fauna.

Post-development mitigation will provide net ecological gain in line with the requirements of Planning Policy Statement (PPS) 9. The opportunities for post-development landscaping on site are limited by available habitat and as such off-site compensation in the local area will be implemented, which is considered to provide a net positive mitigation for the effects of the scheme. MGT will partner with other local industry in the area to re-establish intertidal habitat for a variety of species, including invertebrates and birds.

An Environmental Management Plan (EMP) will be produced and implemented for the site prior to any construction works and will include provisions to protect the wildlife habitat in the vicinity of the site, including the prevention of pollution incidences with potential to impact upon the culverted stream and the Tees.

13.2 Introduction

This section describes the existing ecological features and biodiversity value of the proposed Tees REP development site and its relevant surrounding areas. The significance and probability of any impacts on ecology and nature conservation that could arise as a result of the proposed development are assessed and ways to mitigate for any unavoidable impacts are described.

The proposed development is to be situated on land adjacent to the main southern dock at Teesport on the south bank of the Tees, approximately 5 km east of Middlesbrough and 6 km west of Redcar at approximate grid reference 454300, 523230 as shown in Figure 1.1.

The proposed development site comprises an area of approximately 14 ha, which is inclusive of land proposed for laydown and storage as well as that proposed for a new dedicated 400 kV underground cable to export the electricity generated to an existing National Grid transmission line. Access to the site for construction and operation traffic will follow existing roads from the A1 to the A66, which is directly connected to the site. Biomass will be delivered to a fuel store on site via shipping, to an existing but disused deep water quay that will be reopened for the proposed development. The impact of the reopening of the Quay has not been considered in this assessment as it is the responsibility of the port authority, PD Teesport.

The assessment methodology used followed the stages described in the Ecological Impact Assessment (EcIA) Guidelines (2006) published by the Institute for Ecology and Environmental Management (IEEM)[1].

13.3 Assessment methodology

13.3.1 Overall approach and assessment criteria

The method involves five key stages:

- Consultation;

[1] *Institute of Ecology and Environmental Management (2006). Guidelines for Ecological Impact Assessment in the United Kingdom.*

- Baseline studies and evaluation of ecological receptors;
- Identification of Valued Ecological Receptors;
- Identification and characterization of potential impacts; and,
- Assessment of impact significance.

13.3.2 Desk study and consultation

A review of existing statutory sites of nature conservation interest, including Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) is carried out to aid in the determination of any existing nature conservation interest within 10 km of the proposed development site.

Protected and notable species records and information on any locally designated sites within 2 km of the site are also obtained from consultations with key statutory and non-statutory nature conservation bodies.

The results of the reviews and responses from the above consultations are incorporated into the Baseline Studies and Evaluation of Ecological Receptors section.

13.3.3 Baseline studies and evaluation of ecological receptors

Baseline information regarding ecological features including sites of importance for nature conservation, species populations, species assemblages and habitats are obtained from several key sources including:

- Existing data and information relevant to the site, from published sources, data bases and local recorders; and
- Ecological surveys.

The assessment considers both existing and future predicted baseline conditions. Consequently the description and valuation of ecological features takes account of any likely changes, including for example, trends in the population size or distribution of species, likely changes to the extent of habitats and the effects of other proposed developments or land-use changes.

13.3.4 Identification of valued ecological receptors

It is impractical for an assessment of the ecological effects of a development to consider every species and habitat that may be affected. Instead, it focuses on ‘valued ecological receptors’ (VER). Valued ecological receptors are species and habitats present within the zone of influence of the proposed development that are of sufficiently high value that an effect upon them as a result of the proposed development could be considered to be significant.

The value of sites; populations of species; species assemblages; and habitats are assessed with reference to their importance in terms of ‘biodiversity conservation’ value (which relates to the need to

conserve representative areas of different habitats and the genetic diversity of species populations); and their legal status.

For the purposes of this assessment, sites, species populations, species assemblages and habitats are valued using the following scale:

- International;
- UK
- National (ie England);
- Regional;
- County;
- District;
- Local; and
- Neighbourhood.

The valuation of sites makes use of established value systems eg Sites of Special Scientific Interest are of national importance and County Wildlife Sites are of county importance. Professional judgement is however required for the valuation of sites of less than district value.

The valuation of species populations, assemblages of species and habitats also uses accepted criteria, examples include:

Species populations: the importance of populations can be evaluated on the basis of their size, recognized status (eg published lists of species of conservation concern, Biodiversity Action Plan (BAP) status) and legal protection status. Bird populations, for example, exceeding 1 per cent of published bio-geographic populations are considered to be of international importance, and those exceeding 1 per cent of published national populations are considered to be of national importance, and so forth.

Species assemblages: in some instances it is the species assemblage that is of importance. Criteria of use to evaluate the importance of assemblages included SSSI selection criteria. Fuller (1980) provides a framework for evaluating the relative importance of bird assemblages.

Habitats: criteria for the evaluation of habitats and plant communities include Annex III of the EC Habitats Directive, guidelines for the selection of biological SSSIs and, where available, Local Authority and Wildlife Trust criteria for the selection of Local Sites (eg County Wildlife Sites). Legal protection status is also a consideration for certain habitats.

The IEEM (2006) guidelines note the difficulty of devising valuation criteria that can be consistently applied to designated sites, habitats and species in the same way in all parts of the country, and recommends an approach to valuation that involves teasing apart the different values that can be

attached to the ecological receptors under consideration. However, it is beneficial to give examples of the sorts of criteria used in the valuation process, summarized in Table 13.1 which has been adapted from a similar table included in several of the earlier drafts of the IEEM guidelines.

TABLE 13.1
EXAMPLES OF CRITERIA USED TO EVALUATE ECOLOGICAL RECEPTORS

Level of value	Examples of definitions
International	An internationally important site, eg Special Protection Area (SPA), Special Area of Conservation (SAC) or Ramsar site (or a site considered worthy of such designation); a regularly occurring population of an internationally important species (listed on Annex IV of the Habitats Directive).
National (UK)	A nationally designated site, eg SSSI, or a site considered worthy of such designation; a viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; any regularly occurring population of a nationally important species, eg listed on Schedules 5 and 8 of the Wildlife & Countryside Act (1981); a feature identified as of priority in the UK BAP.
County	Areas of internationally or nationally important habitats which are degraded but are considered readily restored; viable areas of key habitat identified in Local BAPs, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; a site designated as a Wildlife Site or Site of Nature Conservation Interest (SNCI); a regularly occurring, locally significant number of a nationally important species.
District	Areas of habitat identified in a sub-county (district/borough) or in the relevant Natural Area profile; district sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves; sites or features that are scarce within the district or borough or which appreciably enrich the district or borough habitat resource; a diverse or ecologically valuable hedgerow network.
Local	Areas of internationally or nationally important habitats which are degraded and have little or no potential for restoration; a good example of a common or widespread habitat in the local area.
Neighbourhood (site and its vicinity, including areas of habitats contiguous with or linked to those on site)	Areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest; common and widespread species.

In this assessment, sites, species populations, species assemblages and habitats are considered to be valued ecological receptors (VER) if they meet the following minimum level of importance:

- sites – local importance.
- species populations and assemblages – local importance.
- habitats – local importance.

It is considered that no significant effect can occur to features of lesser importance than those listed, except where a feature has high social or economic value.

The description and valuation of ecological features has taken account of any likely changes, including, for example, trends in the population size or distribution of species; likely changes to the extent of habitats; and the effects of other proposed developments or land-use changes.

13.3.5 Identification and characterization of potential impacts

The likely effects of the proposed development during construction and operation, and the potential ecological impacts arising from these effects are identified and characterized, taking into consideration the following parameters:

- Positive or negative – whether the effect will result in net loss or degradation of a VER or whether it will enhance or improve it;
- Magnitude – the size or intensity of the effect measured in relevant terms, eg number of individuals lost or gained, area of habitat lost of created or the degree of change to existing conditions (eg noise or lighting levels);
- Extent – the spatial scope of the effect, for example the physical area affected or the geographical pattern of the effect;
- Duration – the length of time over which the effect occurs;
- Reversibility – the extent to which effects are reversible either spontaneously or through active mitigation; and
- Timing and frequency – consideration of the timing of events in relation to ecological change, some effects may be of greater significance if they take place at certain times of year (eg breeding season). The extent to which an effect is repeated may also be of importance.

13.3.6 Magnitude of potential impacts

Ecological receptors are usually sites, habitats, species assemblages or communities, or populations or groups of a species. Effects can be permanent or temporary, direct or indirect, and can be cumulative. These factors are brought together to assess the magnitude of the impact on particular valued ecological receptors and, wherever possible, the magnitude of the impact is quantified.

Professional judgment is then used to assign the effects on the receptors to one of four classes of magnitude, defined in Table 13.2.

TABLE 13.2
DEFINITION OF MAGNITUDE

Magnitude	Definition
High	A permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status.
Medium	A permanent or long-term effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is unlikely to threaten its sustainability; if beneficial, this is likely to be sustainable but is unlikely to enhance its conservation status.
Low	A permanent or long-term reversible effect on a site, habitat, species assemblage or community, population or group whose magnitude is detectable but will not threaten its integrity.
Negligible	A short-term but reversible effect on the extent or size or integrity of a site, habitat, species assemblage or community, population or group that is within the normal range.

Potential impacts are initially characterized in the absence of any mitigation, except where this is integral to the design of the development. Any additional mitigation or compensation proposed is identified and its likely effectiveness was assessed.

Indications of the confidence with which predictions of potential impacts are made are also given.

13.3.7 Assessment of impact significance

The significance of the predicted impacts on VER arising from the identified effects of the proposed development, including designed-in and additional mitigation measures, are assessed. Significance is assessed as Negative, Positive or Not Significant as described below.

13.3.8 Negative effects

For habitat areas and species, an effect is considered to be significant if the favourable conservation status of a VER is compromised by the final design of the development. Conservation status is defined by the Institute of Ecology and Environmental Management (2006) as being:

- Habitats – “conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area”.

- Species – “conservation status is determined by the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area”.

The decision as to whether the favourable conservation status of a VER is likely to be compromised is made using professional judgement based on an analysis of the predicted effects of the development (including consideration of the specific parameters outlined above).

A similar procedure is used for designated sites that are affected by the development, except that the focus is on the effects on the integrity of each site, defined as “the coherence of ecological structure and function, across a site’s whole area, that enable it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified.” This assessment is made with reference to the features for which a site has been classified/notified and involves combining assessments of the effects on the conservation status of each of these features.

For non-statutory sites, such features may not have been formally defined and will need to be agreed with the designating authority (eg local authority or county wildlife trust).

13.3.9 Positive effects

An effect is considered to be significant if development activities cause:

- A non-valued ecological receptor to become valued;
- Restoration of favourable conservation status for a habitat/species population; and/or,
- Restoration of a site’s integrity (where this has been undermined).

13.3.10 Legislative framework

Whilst Section 6 (Planning Policy Framework) discusses the local planning background against which the proposed development will be considered, including relevant nature conservation plans and policies, the following legislation, policy and guidance documents have been used to underpin the ecological impact assessment reported in this Chapter:

- Habitats and Species Directive (92/43/EEC) 1992;
- Bern Convention (on the Conservation of European Wildlife & Natural Habitats; and on the Conservation of Migratory Species of Wild Animals) 1979;
- Conservation (Natural Habitats and c.) Regulations 1994 (as amended);
- Wildlife & Countryside Act 1981 (and subsequent amendments);
- Countryside and Rights of Way Act 2000;
- Planning Policy Statement on Biodiversity and Geological Conservation (PPS9);

- Natural Environment and Rural Communities (NERC) Act 2006;
- Protection of Badgers Act 1992;
- The UK Biodiversity Action Plan (UKBAP) 1994;
- Tees Valley Local Biodiversity Action Plan;
- Redcar and Cleveland Local Development Framework; and
- Regional Spatial Strategy for the North East.

13.4 Survey methodologies

The baseline was determined and appraised through a combination of field surveys and a desk-based study within 2 km from the approximate centre of the site for notable and protected species and locally designated sites and within 10 km for statutory designated sites.

13.4.1 Desk study

The following statutory and non- statutory consultees were consulted:

- Redcar and Cleveland Borough Council;
- Tees Valley Wildlife Trust;
- Royal Society for the Protection of Birds;
- Natural England;
- Environment Agency;
- EYE Project – Regional Environmental Data Hub;
- Yorkshire/Cleveland Bat Group; and
- Cleveland Badger Group (no reply was received).

Consultation was also made with a local specialist (Geoff Barber of INCA UK) to supplement the publicly available data. INCA is a membership organization providing environmental and ecological consultancy to businesses in the Tees Valley established in 1989.

To gain further knowledge of ecological issues in the wider area, the following were searched:

- NBN Gateway;
- Multi-Agency Geographic Information for the Countryside (MAGIC);
- UK Biodiversity Action Plan (BAP); and

- The Tees Valley local BAP, which reflects the aims and objectives of the national plans for the habitats and species found in the local area.

A review of data available from previous ecological studies on sites adjacent to the proposed development was also undertaken these being the Environmental Statement (ES) and associated appendices for the Northern Gateway Container Terminal[2].

13.4.2 Field survey

13.4.2.1 Extended Phase 1 Habitat Survey

An Extended Phase 1 Habitat Survey was undertaken by suitably experienced ecologists on 3 April 2008. The survey was carried out to map habitat types and identify the presence or potential presence of ecological constraints to the proposed development.

The Extended Phase 1 Habitat Survey followed standard methodology[3] and focussed on the site of proposed development as described above and the relevant surrounding area (at least a 30m buffer from the proposed development works), the combination of which is hereafter referred to as the 'survey area'.

13.4.2.2 Reptile presence/absence survey

The presence of protected but generally common and widespread UK reptile species was identified as a potentially important ecological constraint during the Extended Phase 1 Habitat Survey, given the presence of suitable supporting habitat within the study area. The Reptile Atlas of North East England[4] reports that common lizards (*Lacerta vivipara*) have been recorded on both sides of the river in industrial waste ground at Teesmouth and to a lesser extent, slow worms (*Anguis fragilis*) have been recorded in the wider area at Hartlepool and Redcar.

The Wildlife and Countryside Act 1981 (WCA, 1981) (as amended) protects grass snakes (*Natrix natrix)*, slow worms, adders (*Vipera berus*) and common lizards making it an offence to deliberately or intentionally kill or injure or sell or trade these species. Other UK reptile species namely smooth snakes (*Coronella austriaca*) and sand lizards (*Lacerta agilis*) have additional protection under the Wildlife and Countryside Act, 1981 (as amended) and the Habitat Regulations (1994). Suitable habitat for adder and grass snakes were not found on site and in addition, both are regionally rare. Smooth snakes are not found in the north of the country and although attempts have been made to reintroduce sand lizards to Teesmouth, it has been with limited success only and thus their presence was not considered a likely constraint.

A presence/absence survey for reptiles was undertaken during April and June 2008 using a total of 67 artificial refugia within the proposed development site. The site was surveyed on eight occasions over a total of eight days during weather conditions suitable for reptiles to bask (generally dry cloudy/sunny weather with temperatures between 10°C and 20°C).

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2 *Environmental Statement Northern Gateway Teesport Container Terminal (Royal Haskoning, 2006).*

3 *Handbook for Phase 1 Habitat Survey: a Technique for Environmental Audit published by the Joint Nature Conservation Committee (JNCC 1993).*

4 *Reptile Atlas of North East England, J. L. Durkin (January, 2008).*

Full details of the methods employed can be found in Appendix G.

13.4.3 Data limitations

It should be noted that the data search provided information on habitats and species already recorded and cannot be taken to represent a complete overview of all species present in the survey area. It is considered that the historic records coupled with the site visit provide a good insight into the potential presence of various species and habitat types at this site however and have allowed a general assessment of the site's potential nature conservation value to be made.

Whilst every effort has been made to undertake the ecological surveys at the appropriate time of year, and appropriately qualified experts have been used in all cases, seasonal trends and inherent variations in ecosystem dynamics mean that some species of flora and fauna may not have been recorded. In addition the following specific points relating to the surveys should be noted, and have been taken into account during the impact assessment.

Certain areas of the site were observed by sight only, specifically in the location of the proposed underground cables and tower. It was considered that a suitable assessment could be made from the boundary of this area however given its current use.

13.4.4 Existing (baseline) environment

13.4.4.1 Internationally designated sites

There is one internationally designated area of nature conservation importance within 10 km of the proposed development site. The 'Teesmouth and Cleveland Coast' Special Protection Area (SPA) and Ramsar site is comprised of several component parts, the closest of which is located approximately 1.5 km to the south-west of the development site. This closest component also forms part of the Tees & Hartlepool Foreshore and Wetlands SSSI.

The Ramsar site (wetland of international importance designated under the Ramsar Convention, 1971) covers an area of 1247.31 ha and is designated under criterion 5 and 6 of the Convention. It is a medium-large site encompassing a range of habitats (sand and mudflats, rocky shore, saltmarsh, freshwater marsh and sand dunes) on and around an estuary which has been much modified by human activities. Together these habitats support internationally important numbers of water birds. Under Ramsar criterion 5 it supports assemblages of international important species of waterfowl, with a 5 year peak mean (1998/99-2002/03) of 9528 individuals. Under Ramsar criterion 6, the Teesmouth and Cleveland Coast supports species/populations occurring at levels of international importance.

The Teesmouth and Cleveland Coast SPA cover an area of 1247.31 ha and comprise an enclosed coastal area with mudflats, coastal dunes, intertidal rock, salt marshes and marshes. The SPA qualified under Article 4.1 of the Directive on the Conservation of Wild Birds (79/409/EEC) by supporting populations of the following European important species listed on Annex I of the Directive: little tern (*Sterna albifrons)* during the breeding season and sandwich tern (*Sterna sandvicensis)* on passage. In addition, the site has qualified under Article 4.2 of the Directive (79/409/EEC) by supporting populations of the following European important migratory species: over winter the area regularly supports populations of red knot (*Calidris canutus*) and populations of common redshank

(*Tringa totanus*) on passage. The area also supports an internationally important assemblage of 21 312 individual over wintering waterfowl (5 year peak mean 01/03/2000).

13.4.4.2 Nationally designated sites

There are eight Sites of Special Scientific Interest (SSSI) within 10 km of the proposed development site, as summarized in Table 13.3.

SSSIs are notified by Natural England for being the best examples of the UK's flora, fauna, or geological or physiographical features. These sites are also used to underpin other national and international nature conservation designations such as Special Areas of Conservation (SACs) and SPAs.

TABLE 13.3
STATUTORY DESIGNATED SITES WITHIN 10 km OF THE PROPOSED DEVELOPMENT

Site	Grid reference	Size (ha)	Distance from proposed development site (centre – centre)	Description
Seal Sands SSSI	NZ 529260	294.37	2.9 km north	Seal Sands are the only extensive area of intertidal mudflats, with tidal channels on the East coast of England between the Lindisfarne National Nature Reserve to the north and the Humber Estuary to the south, a distance of 200 miles. These mudflats are of great ornithological importance attracting large numbers of migratory wildfowl (c. 4000) and wading birds (c. 24 000) especially during the winter months.
Redcar Rocks SSSI	NZ 605253 NZ 620253	31.1	6.6 km north-east	Redcar Rocks represent the finest exposures of rock in the Lower Lias north of the Market Weighton Swell ie in the Yorkshire Basin. When exposed at low tide the rocks and sands provide an important feeding ground for several species of wading birds eg red knot, turnstone (*Arenaria interpres*), sanderling (*Calidris alba*) and purple sandpiper (*Calidris maritima*), especially during the winter months.

Site	Grid reference	Size (ha)	Distance from proposed development site (centre – centre)	Description
Lovell Hill Pools SSSI	NZ 596189	9.2	6.8 km south-east	Lovell Hill Pools is set within an undulating, well-wooded agricultural landscape to the north of the North York Moors. The site supports an outstanding assemblage of dragonflies and damselflies. The pools owe their origin to mining subsidence, and comprise a series of shallow water bodies fringed by swamp vegetation, damp neutral grassland, willow carr and scrub. The intimate mosaic of habitats provides sheltered breeding and feeding sites for insects in general and particularly, dragonflies.
Cowpen Marsh SSSI	NZ 500529	121.56	4.3 km north-west	The site known as Cowpen Marsh includes the largest saltmarsh between Lindisfarne and the Humber Estuary and together with adjacent coastal grazing marshes and mudflats it provides an important wintering site for migratory wildfowl and wading birds. It forms an integral part of Tees Estuary, a site of international importance for over wintering shore birds.
South Gare & Coatham Sands SSSI	NZ 547262-NZ 617264	396.35	3.7 km north-east	The site known as South Gare and Coatham Sands is of considerable interest for its flora, invertebrate fauna and birdlife. The range of habitats present includes extensive tracts of intertidal mud and sand, sand dunes, saltmarsh and freshwater marsh. The sand dunes are dominated by marram grass (*Ammophila arenaria*). Areas of mud and sand-flat provide important winter feeding grounds for bar-tailed godwit (*Limosa lapponica*), curlew (*Numenius arquata*), redshank, dunlin (*Calidris alpina*) and grey plover (*Pluvialis squatarola*),. Further intertidal areas along Coatham Sands support an internationally important population of sanderling. Both areas support ringed plover (*Charadrius hiaticula*) on passage migration (c. 150 birds). Red knots feed along the intertidal areas, the breakwater and on the mussel beds of the German Charlies and Coatham Rocks. These latter areas also support turnstone (c. 180 birds), purple sandpiper and oystercatcher (*Haematopus ostralegus*).

Site	Grid reference	Size (ha)	Distance from proposed development site (centre – centre)	Description
Tees & Hartlepool Foreshore and Wetlands SSSI	NZ 516348, NZ 519327, NZ 517261, NZ 493232, NZ 505224, NZ 509229, NZ 513230 and NZ 524220	255.62	Various areas around the site, the closets being 1.5 km south-west.	Tees and Hartlepool Foreshore and Wetlands comprise several coastal areas which are an integral part of the complex of wetlands, estuarine and maritime sites supporting the internationally important population of wildfowl and waders on the Tees Estuary.
Seaton Dunes & Common SSSI	NZ 535285	312.1	5.8 km north	This site forms part of 'Teesmouth Flats and Marshes', a complex of sites. Seaton Dunes and Common is an area of considerable importance for its flora, invertebrate fauna, and bird life. The range of habitats present include sandy, muddy and rocky foreshore, dunes, dune slacks and dune grassland, as well as relict saltmarsh, grazed freshwater marsh with dykes (known locally as fleets and stells) pools and seawalls.
Hartlepool Submerged Forest SSSI	NZ 520315	19.7	8.5 km north	The coast at Hartlepool provides important stratigraphic evidence for Flandrian sea-level changes in Eastern England. The interest comprises a sequence of inorganic and organic deposits, including a peat bed, in the intertidal area. The deposits have yielded pollen molluscs, and archaeological remains, which together with radiocarbon dating have been used to establish the pattern of relative sea-level change over the last 5,000 years.

The locations of the statutory sites are shown on Figure 13.2 and full site citations are included within Appendix H.

13.4.4.3 Locally designated sites

There are no locally designated sites of nature conservation importance located within 2 km of the proposed development site.

13.4.4.4 Locally notable habitats

Bran Sands Lagoon (situated approximately 1.5 km to the east of the proposed development site) and Vopak Foreshore (approximately 0.75 km to the north and east on the opposite side of the channel)

have been identified in the scoping response received from Natural England[5] as being of ecological significance. This is due to their potential to support bird species associated with the designated sites in the wider area, particularly the Teesmouth and Cleveland Coast SPA, Ramsar site and Tees and Hartlepool Foreshore and Wetlands SSSI. As a result, Bran Sands and Vopak Foreshore are considered as Valued Ecological Receptors (VER) in this assessment due to their secondary supporting features.

Bran Sands Lagoon and Vopak Foreshore were surveyed as part of the Northern Gateway Container Terminal ES. Bran Sands was found to be a disturbed site comprised of part active and capped landfill and large part open water with areas of improved and rough grassland; wasteland; hard standing and buildings; and some intertidal habitat and associated communities. Vopak Foreshore was found to be a small site comprised of a mosaic of wasteland vegetation, discarded construction materials (including rubble), open water, sand and some intertidal habitat with associated communities.

13.4.4.5 Site habitats

The Phase 1 Habitat map (Figure 13.3) depicts habitat types recorded within the survey area. Target notes (TN) are given on the map to identify features of particular interest within the survey area; these are described in Appendix I.

The proposed development site habitats were found to be limited to semi-improved grassland with a mixture of short ephemeral species and young scrub interspersing areas of hardstanding for existing businesses, or made ground consisting of processed slag from the nearby industrial processing plants.

The southern section of the site contained existing business units associated with a tyre fitting firm servicing the docks. The north-east edge of the site housed an active transit shed for the moving of dock materials on trains. The building was predominantly made of steel and of open composition, allowing trains in and out, as well as heavy machinery.

Outside of the southern boundary of the proposed development site a road bridge crossed over a culverted stream. The water quality at this location was considered to be poor, with oily residues on the surface of the water and no emergent vegetation. The riparian area comprised limited areas of short sward grassland only. The road crossing the stream led to an active slag processing plant with no visible vegetation. The habitats along the roadside were predominantly hard standing with an active railway to the east which enabled dockside materials to be transported throughout the Teesport Dock area.

Situated to the west and south of the proposed development site boundary, but within the survey area were several disused oil tanks for industrial use. The tanks were in a state of disrepair and surrounding habitats present included scrub and semi-improved grassland, a number of individual bee orchids (*Ophrys apifera*) were recorded in this area. The scrub comprised immature willows (*Salix* sp.) with bramble (*Rubus fruticosus*) interspersed around the base of the tanks, with semi-improved grassland and tall ruderals within the confines of the area.

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5 *Natural England Scoping Opinion – Tees Renewable Energy Plant, received 9th April 2008*

13.4.5 Notable species

13.4.5.1 Invertebrates

There are no recent records of protected or notable invertebrates held by the EYE Project and Tyne & Wear Museum or National Biodiversity Network (NBN) within 2 km of the proposed development site. Some of the protected sites more than 1.5 km distant, as described above are however noted to be of importance for invertebrates, as described below.

The Teesmouth and Cleveland Coast Ramsar have a diverse invertebrate species assemblage occurring on the site. These include the marsh flies (*Pherbellia grisescens*) and (*Thereva valida*), flea beetle (*Longitarsus nigerrimus*), long-toed water beetle (*Dryops nitidulus*), leaf beetle (*Macroplea mutica*), rove beetle (*Philonthus dimidiatipennis*) and round fungus beetle (*Trichohydnobius suturalis*) all of which are included in the British Red Data Book (RDB) [6] [7].

The Love Hill Pools SSSI supports an outstanding assemblage of dragonflies and damselflies including the nationally scarce variable damselfly (*Coenagrion pulchellum*) and the dingy skipper butterfly (*Erynnis tages*), which is also a UK Priority Species listed under the UK Biodiversity Action Plan.

The invertebrate fauna of South Gare & Coatham Sands SSSI is rich and includes several species of butterfly; several uncommon beetles, notably the ground beetle (*Broscus cephalotes*), the water beetle (*Enochrus quadripunctatus*); and rare spiders such as the money spider (*Silometopus incurvatus*), which is also a priority species under the UK BAP, and the woodlouse spider (*Dysdera crocata).*

Within the Seaton Dunes and Common SSSI, two nationally rare species of beetle occur, namely the small scavenger beetle (*Hydnobius perrisi)* and rove beetle.

Based on the findings of the Extended Phase 1 Habitat survey it was concluded that the habitats within the survey area were highly unlikely to support invertebrate species of particular conservation importance and therefore no further survey work was undertaken.

Invertebrates of conservation interest have only be noted associated with designated sites at a significant distance (the closest being 1.5 km distant) from the proposed development site and as such are not considered as ecological receptors of sufficient value to be addressed further in this assessment.

13.4.5.2 Flora

There are no recent records held by the EYE Project and Tyne & Wear Museum for protected or notable flora species within 2 km of the proposed development site. Most of the protected sites more

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[6] *Shirt, D.B. (ed.), (1987). British Red Data Books: 2. Insects. NCC, Peterborough*

[7] *Bratton, J.H. (ed.), (1991). British Red Data Books: 3. Invertebrates other than insects. JNCC, Peterborough.*

than 1.5 km distant, as described above are however noted to be of importance for supported flora and/or habitat type.

The 'Teesmouth and Cleveland Coast' Ramsar site contains nationally important higher plant species including sand fescue (*Festuca arenaria),* British alkaligrass (*Puccinellia rupestris*) and brackish Water-crowfoot (*Ranunculus baudotii)* all of which are nationally scarce.

South Gare & Coatham Sands SSSI support one of the largest continuous stands of lyme grass (*Leymus arenarius*) in Britain. Within the developing saltmarsh notable plants include sea wormwood *(Artemisia maritime)*, lesser sea spurrey (*Spergularia marina)*, lax-flowered sea lavender (*Limonium humile)*, sea purslane (*Halimione portulacoides)* and smallest hares ear (*Bupleurum tenuissimum*). Parsley water dropwort (*Oenanthe lachenalii)* is of particular interest amongst the fresh water marsh communities dominated by great reedmace (*Typha latifolia)*, rushes (*Juncus spp*.) and sedges (Carex spp.).

The dune flora of the Seaton Dunes & Common SSSI is particularly rich and includes the nationally rare rush-leaved fescue (*Festuca juncifolia*) and sea couch (*Agrophyron pungens*) at its northernmost locality, as well as purple milk vetch (*Astragalus danicus)*, blue fleabane (*Erigeron acer)* and yellow wort (*Blackstonia perfoliata)* which have a limited distribution and are associated with the lime-rich slag of the dune covered sea walls. On the landward side of the dunes there are areas of dune slack supporting large populations of common spotted and marsh orchids (*Dactylorhiza spp*.) as well as their hybrids including several locally rare forms. The remainder of the site supports uncommon plants such as strawberry clover (*Trifolium fragiferum*) wild celery (*Apium graveolens)*, knotted hedge parsley (*Torilis nodosa)* and adder's tongue fern (*Ophioglossum vulgatum)*.

Based on the findings of the Extended Phase 1 Habitat survey it was concluded that the habitats within the survey area were highly unlikely to support a diverse flora mix or protected species and therefore no further botanical survey work was undertaken.

Flora of conservation interest has only been noted as associated with designated sites at a significant distance from the proposed development site and is such is not considered as a Valued Ecological Receptor (VER) to be addressed any further in this assessment.

13.4.5.3 Birds

The majority of records relating to the presence of bird species in the wider area are likely to be associated with the national and international designated sites described above (refer to Appendix J for additional records obtained). The citation for the Tees and Hartlepool Foreshore and Wetlands SSSI supports this supposition by indicating that birds disperse to both inland wetlands and various coastal locations at different stages of the tide.

The desk study identified records of several bird species of conservation interest located within the Teesmouth and Cleveland Coast SPA and Ramsar site including those that are designating features. Birds recorded included the following species during the breeding season; red Knot, little tern, sandwich tern and common redshank. In winter the Tees and Hartlepool Foreshore and Wetlands SSSI supports nationally important numbers of purple sandpiper, sanderling, and shoveler (*Anas*

clypeata) as well as several nationally important assemblages of breeding birds during the spring/summer.

In addition to the records associated with protected sites, the EYE Project and Tyne & Wear Museum reported species recorded within 2 km of the site that are listed under the Amber List of Birds of Conservation Concern (2002-2007) including teal (*Anas crecca*), meadow pipit (*Anthus pratensis*), stock dove (*Columba oenas*), snipe (*Gallinago gallinago*), and curlew. Also listed under the Red List of Birds of Conservation Concern (2002-2007) were starling (*Sturnus vulgaris*) and grey partridge (*Perdix perdix*), which are both UK and LBAP priority species.

Dedicated breeding bird surveys of the area immediately east of the proposed development site were carried out in 2005 as part of the Northern Gateway Container Terminal ES. The surveys also included an assessment of the adjacent habitat at Bran Sands and Vopak Foreshore. Bran Sands was separated into the north and south components, the south predominately consisting of a lagoon. These surveys indicated that the sites were overall of local importance to breeding birds in 2005 and contained habitat well represented in the wider area. Little ringed plover, protected under Schedule 1 of the Wildlife and Countryside Act (1981, as amended), was recorded without evidence of breeding and several red list species including skylark (*Alauda arvensis)*, linnet (*Carduelis cannabina*), reed bunting (*Emberiza schoeniclus*), starling and lapwing (*Vanellus vanellus*) were recorded as breeding. Of note however was the presence of Annex I species common tern (*Sterna hirundo*), with 20 breeding pairs recorded at Bran Sands south. Their presence was attributed to two floating tern rafts; the last remaining of a group of several rafts that have subsequently been subject to phased removal from the area.

Wetland Birds Survey (WeBS) data (1999 – 2004) was analysed in 2006 as part of the Northern Gateway Container Terminal ES and it was identified that Bran Sands south was at this time likely to have been of importance to water birds in the Tees estuary for a number of notable species (including sandwich tern, common tern and redshank listed in the SSSI notification). Up to 6.6 per cent of the estuary's sandwich tern population and 56 per cent of the estuary's common tern population were supported by Bran Sands south during the autumn period. Due to limited mudflat habitat at this location it was considered in the assessment that Bran Sands south would be of most interest for roosting during high water when other areas of the estuary would not be available for feeding (with the exception of the additional, artificial habitat offered by the tern rafts). This situation would not be uncommon for other similar coastal and inland habitats that form part of the mosaic of such sites used by bird species at various stages of the tide on an occasional basis.

The more recent situation (2004 to date) supported by the 2005 survey would suggest that the relative value of Bran Sands for supporting common and sandwich tern has been much reduced due to the now complete removal of the tern rafts and their relocation to the north of the estuary. On the basis of the data described above, it is considered that Bran Sands south is likely to retain its importance only at high tide along with other habitats in the locale.

The WeBS analysis carried out in 2006 concluded that SSSIs in the surrounding area of the proposed development site were of importance to notable bird species associated with the estuary, including those of European importance supported by the SPA. It is likely that this importance will not be just be limited to high tide periods due to the presence of substantial areas of intertidal habitat, rather, they will be utilized on a more frequent basis for foraging and/or breeding. It is also likely that the relatively

low number of components of intertidal habitats at Bran Sands (north) and Vopak Foreshore will also be used on a less frequent basis than the SSSIs in the wider area. Bran Sands north was considered important by the analysis of WeBS data in the context of the estuary for species including the Schedule 1 species, black tailed godwit (*Limosa limosa*) as part of the Northern Gateway Container Terminal ES.

It is noted that with the exception of Bran Sands, which is approximately 1.5 km to the east, the SSSIs described above are all located on the opposite channel to the proposed development site.

During site visits undertaken as part of the Extended Phase 1 Habitat survey and the reptile presence/absence survey, incidental sightings were made of skylark in flight over the proposed development site. No other notable or protected bird species were recorded.

No habitat of particular interest within the site boundary, including brownfield land and intertidal habitat for protected or notable water birds was identified during the Extended Phase 1 Habitat survey and as such no further survey was undertaken.

Four jetties are found in proximity, the closest of which is approximately 40 m outside of the proposed site boundary, extending approximately 15 m into the Tees. The jetties offer moderate potential for roosting wading birds; however, they are all operational and as such are considered to be unsuitable for supporting roosting waders in significant numbers.

Terrestrial birds generally rely on a wide variety of habitats, including some of which were noted on the proposed development site and as such terrestrial birds are likely to form a localized constraint to development and are considered as an ecological receptor of local importance.

All birds are protected from killing or disturbance during the nesting season (generally taken to be between March and September inclusive). Schedule 1 species have additional protection covering reckless disturbance.

13.4.5.4 Mammals

There are no recent records of protected or notable mammals within 2 km of the proposed development site, held by the EYE Project and Tyne & Wear Museum or the local bat group; however the NBN have records (1998-2008) of the water vole (*Arvicola terrestris)* being recorded within 2 km of the site.

The water vole is protected under the Wildlife and Countryside Act 1981 (as amended). It is an offence to possess, control or sell water voles or to intentionally kill, injure or take water voles. It is also an offence to intentionally or recklessly damage, destroy or obstruct access to a place that water voles use for shelter or protection or disturb water voles whilst using such a place.

Based on the findings of the Extended Phase 1 Habitat survey it was concluded that there were no habitats within the survey area that could support water voles as such no further survey work was undertaken and water voles have not been considered any further in this assessment.

During the Phase 1 habitat assessment buildings and habitat were not considered to have potential to support roosting bats. The paucity of suitable foraging and commuting habitat on the development site also suggested that it would be unlikely that bats would use the site on anything more than an occasional basis. The site is also highly exposed to the Tees. The river corridor is a generally highly disturbed environment as a result of the shipping traffic and a number of other active quays are in operation to the west, east and north. The potential for bats to use the river corridor for commuting therefore is considered to be negligible.

Dedicated surveys carried out as part of the Northern Gateway Container Terminal ES to the east of the site did not record roosting bats. Limited foraging activity of five individuals of two common species (pipistrelle (*Pipistrellus* spp.) and noctule (*Nyctalus noctula*)) was recorded around the ponds and surrounding grassland within their application boundary. Similar habitat for foraging bats within the Northern Gateway Contained Terminal was not present within the proposed development site boundary.

On the basis of the above, the potential occasional use of the site by bats is not considered to form a significant constraint to the proposed development. However, standard construction environmental management may increase the confidence of such a statement and as such they are considered further in this assessment as a precautionary measure.

13.4.5.5 Amphibians

No great crested newts (*Triturus cristatus*) have been recorded within 2 km of the study area.

The great crested newt is protected under the Wildlife and Countryside Act 1981 (as amended), and under The Conservation (Natural Habitats, &c.) Regulations, 1994 (as amended). It is illegal to deliberately capture, injure or kill a great crested newt, to intentionally or recklessly disturb great crested newts, or to deliberately take or destroy the eggs of great crested newts. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding or resting place used by a great crested newt. All life stages of great crested newts are afforded the same level of protection.

The Extended Phase 1 Habitat survey did not identify any habitats within the proposed development site suitable to support the aquatic phase of great crested newts and connectivity to the nearest known population at Lovell Hill Pools SSSI more than 6 km distant is extremely limited. In addition, it is considered highly unlikely that the terrestrial phase of GCN would be supported within the proposed development site due to the lack of suitable connecting aquatic habitat within 500 m (of a breeding pond) and limited areas of suitable vegetative cover for foraging or frost free hibernation. Furthermore, dedicated survey work undertaken in 2005 for the Northern Gateway Container Terminal ES found that great crested newts were not present in waterbodies considered suitable in the surrounding area; the nearest of these waterbodies is more than 800 m from the proposed development site and dissected in connectivity by the A1053 and substantial areas of other hard standing environments.

As a result of the above considerations, no further survey work was undertaken for great crested newts and they have not been considered further in this assessment.

13.4.5.6 Reptiles

Reptiles were not found present during a dedicated reptile survey carried out under suitable conditions following standard guidelines between April and June 2008. As a result of the survey, reptiles are considered absent from the site and as such are not assessed any further as valued ecological receptors.

13.4.6 Assessment of valued ecological receptors

Each habitat and species or species assemblage recorded has been assigned an ecological value according to the geographical scale at which it is important in accordance with the IEEM guidelines. Where sites have designations at different levels (International, National and Regional/County/Local) the highest value has been assigned.

TABLE 13.4
SUMMARY OF VALUED ECOLOGICAL RECEPTORS

Site/habitat/species	Value	Evaluation rationale
Teesmouth and Cleveland Coast Special Protection Area (SPA) and Ramsar site	International	Component Ramsar Site and SPA Internationally designated statutory site
Seal Sands SSSI	National	Nationally designated statutory site (SSSI)
Redcar Rocks SSSI	National	Nationally designated statutory site (SSSI)
Lovell Hill Pools SSSI	National	Nationally designated statutory site (SSSI)
Cowpen Marsh SSSI	National	Nationally designated statutory site (SSSI)
South Gare & Coatham Sands SSSI	National	Nationally designated statutory site (SSSI)
Tees & Hartlepool Foreshore and Wetlands SSSI	National	Nationally designated statutory site (SSSI)
Seaton Dunes & Common SSSI	National	Nationally designated statutory site (SSSI)
Hartlepool Submerged Forest SSSI	National	Nationally designated statutory site (SSSI)
Bran Sands	Local-District	Good example of habitat represented in the wider area. Limited areas of intertidal habitat and more substantial lagoons habitat both of which form part of a mosaic of similar and more substantial habitat represented by the SSSIs in the wider area. Support of Schedule 1 species.

Site/habitat/species	Value	Evaluation rationale
Vopak Foreshore	Local	Good example of habitat represented in the wider area. Limited areas of intertidal habitat (and lagoons in Bran sands south) form part of a mosaic of similar and more substantial habitat represented by the SSSIs in the wider area.
Semi-improved grassland	Neighbourhood	Extremely common habitat type in local, county and national contexts, with limited biodiversity and negligible conservation interest. This habitat is not considered further in this assessment.
Ruderal	Neighbourhood	Extremely common habitat type in local, county and national contexts, with limited biodiversity and negligible conservation interest. This habitat is not considered further in this assessment.
Scrub	Neighbourhood	Extremely common habitat type in local, county and national contexts, with limited biodiversity and negligible conservation interest. This habitat is not considered further in this assessment.
Culverted stream and drainage	Neighbourhood	Adjacent to the proposed development site. This stream is of extremely poor quality and of limited conservation interest. It provides low quality habitat for species and is considered to be of neighbourhood value. This habitat is not considered further in this assessment.
Bats	Local	UK bat species are protected under the Wildlife & Countryside Act 1981 and The Conservation Regulations (Natural Habitats &c.) 1994. This legislation ensures that individual bats and their breeding sites and resting places are protected as well as areas of particular importance to foraging. The proposed site is considered unlikely to contain active roost sites and is considered to be of low value for foraging and commuting bats. Low numbers of relatively common species have been recorded within 2 km in habitat not represented by the proposed development site. Potential impacts to bats are considered further in light of their protected status
Terrestrial birds	Local	All breeding birds receive protection under the Wildlife & Countryside Act 1981 (as amended). There is potential for a limited range of terrestrial breeding species within the proposed development site boundary. Breeding status and abundance within adjacent habitats is unknown therefore a precautionary value has been applied.
Water birds (associated with the designated sites)	National - International	Intertidal habitats in the surrounding 10 km support important populations of SPA citation species.

13.5 Predicted changes in baseline

The EIA assessment baseline entails the following known changes to the existing situation within the proposed project's phases of construction, operation and decommissioning.

Construction is expected to commence in the middle of 2010 with a target date for full operation summer 2012. The development will be operational for a period of 25 years. Currently the habitat consists of former industrial use with several active business units, which will be replaced by the proposed development.

The substantial new buildings envisaged on site will be the turbine hall, boiler plant, air cooled condenser, wood storage area and storage tanks, the tallest of these structures will be 95 m high stacks. The remaining plant and equipment will, in the main, be housed in relatively low buildings, of the order of 3 to 6 m in height.

Significant changes in baseline conditions for the VERs identified above, during the period of the development, are considered unlikely.

13.5.1 Potential impacts

The methodology used to identify and characterize potential impacts, and assess the significance of these impacts is described in detail above. In summary, this section identifies the likely effects on Valued Ecological receptors (VER) of the proposed development during construction, operation and decommissioning and characterizes the potential ecological impacts that are likely to arise, taking into consideration the following parameters: positive/negative effect, magnitude, extent, duration, reversibility, and timing/frequency.

The impacts are assessed on the basis of the details of construction, operation and eventual decommissioning of the proposed development. For the purpose of this assessment the effects of decommissioning the development are considered to be as per those of construction and of no greater significance.

The potential impacts of the proposed development proposals to the valuable ecological features are identified as follows:

13.5.2 Site clearance and construction impacts

Clearance of vegetation prior to earthworks and construction would remove habitats and could harm, kill or displace the resident fauna. In addition the removal of habitats could have indirect effects on species in adjacent habitats. For example habitat fragmentation could impact the viability of local populations of species and/or impede with the dispersal patterns of some species. In relation to this proposed development the construction impacts may involve:

- Direct loss of habitat and associated impacts on species that utilize them;
- Direct mortality during site clearance and construction;

- Direct and indirect disturbance from construction activities including visual, noise, and lighting; and
- Pollution caused by use of hazardous materials and release of waste materials.

13.5.2.1 Designated sites

No loss of habitat at statutory sites will occur as a result of the development proposals. However, effects may occur as a result of indirect impacts such as changes in air quality and a detailed assessment for this parameter is given in Section 13.5.4. In summary, it is considered that statutory sites are located sufficiently far away (the nearest site being 1.5 km distant) from the proposed development to have no significant effect arising from potential negative air quality impacts (predominately dust) during the construction period. Statutory sites are also considered to be sufficiently distant to be unaffected by noise/vibration disturbance impacts as described in Section 13.5.7.

The magnitude of noise and air impacts will result in no change to any statutory sites and are therefore considered **not significant**.

The designated sites within 10 km of the proposed development are predominately noted for their ornithological interest. The impact upon associated species is considered separately in the section on water birds, below.

13.5.2.2 Notable local habitats (Bran Sands Lagoon and Vopak Foreshore)

No loss of notable local habitat will occur as a result of the development proposals. Potential negative effects on these areas as a result of air quality changes (predominately dust) during the construction processes are considered to be of **negligible magnitude** as the proposed development site is sited approximately 1 km distant and is separated from Bran Sands by the development of the Northern Gateway Container Terminal and from Vopak Foreshore on the opposite bank of the Tees by approximately 0.75 km of the river. These local habitats are also considered to be sufficiently distant to be unaffected by noise/vibration disturbance impacts due to the already heavily disturbed local environment.

Indirect impacts resulting from pollution incidences or contaminated run-off may have a detrimental effect on the River Tees and thus on the adjacent Bran Sands and Vopak Foreshore. However, as part of designed-in mitigation, all run-off and drainage will be managed as part of the Construction Environmental Management Plan (CEMP) and agreements with the Environment Agency and Northumbria Water. The potential impacts to locally notable sites are, as a result, considered to be **not significant**.

Bird species associated with the designated sites described above are known to use these notable local habitats. The impact upon the associated species is considered separately in the section on water birds, below.

13.5.2.3 Site habitats

The on-site habitats that would be lost as a result of the proposed development comprise of very common habitats providing very low conservation interest and as such are not considered as VERs.

13.5.2.4 Species

13.5.2.4.1 Bats

Impacts to bats are considered unlikely to occur as a result of no suitable roosting opportunities and very limited foraging and commuting habitat within the proposed development site footprint and more optimal foraging and commuting habitat at some distance (approximately 0.75 km) offsite. In the unlikely event of impacts, these may arise through increased levels of lighting (for example along a flight corridor) used during both construction and operation. Some bat species use lighting as an aid to foraging (due to the lights attracting moths and other flying insects) whilst the effects on other species can be negative from disturbance and increased risk of predation. Lighting can be particularly harmful along corridor routes that can effectively cause a barrier through which bats will not pass. It is considered that bats will only use the site on an occasional or opportunistic basis and as a result the effect of the impacts of lighting is likely to be negligible and **not significant**.

13.5.2.4.2 Terrestrial birds

All breeding birds receive protection under the Wildlife & Countryside Act 1981 (as amended) and therefore the removal of any nesting habitat (scrub and buildings) will need to take place outside of the breeding season (March – September) unless surveys confirming breeding bird absence are undertaken. The development site habitats are considered to be of low conservation value and highly unlikely to support a bird assemblage of conservation importance but could support individual species of conservation interest. Habitats adjacent to the site that have the potential to support a range of terrestrial breeding bird species are sited at such a distance that indirect disturbance impacts are unlikely during the construction period.

The potential impacts to terrestrial birds using the site scrub habitat and buildings, through habitat loss, are assessed as being **significant** at a **local level**.

13.5.2.4.3 Water birds

The potential impacts to water birds associated with the European and nationally designated sites arising during the construction process are principally in association with air quality changes and noise/vibration and visual disturbance.

It is considered that due to the distance of the designated sites (the closest being 1.5 km), disturbance to birds whilst *in-situ* is highly unlikely. However, water birds may use habitat closer to the site, as described below.

There is considerable debate into the effects of visual and noise disturbance on birds and bird populations[8] [9]. Assessments of whether disturbance has a negative effect on populations often relies on monitoring behavioural responses to disturbance, such as the closest distance to which a disturbance source is approached or the time for animals to return after disturbance has ceased, and it is often assumed that a larger behavioural response indicates a greater susceptibility to disturbance[10]. However, in general terms, the zone of influence (ZOI) is considered an important factor and whilst ZOI can vary from species to species the magnitude of disturbance events generally decline rapidly with distance.

Research suggests that visual disturbance appears to have greatest effect to birds. Furthermore there is evidence to suggest that people are one of the greatest forms of visual disturbance and that when birds see a person or people against the skyline the disturbance effect can be significant.

The distance of the proposed development to Bran Sands and Vopak Foreshore is considered sufficient (the closest being 0.75 km) to be outside of the ZOI for most species and render any noise and visual disturbance as of **negligible magnitude**. In addition, it is noted that the issues that disturbance can cause waterbirds in intertidal zones is predominately due to the tidal restrictions on their foraging, which at Bran Sands and Vopak Foreshore is relatively limited. Furthermore, although a 95 m high stack will be used, the associated magnitude of change visually is not predicted to be significant given the industrial setting of the site which already surrounds the wider Teesside industrial area. **The impact is considered not significant**.

13.5.3 Operational impacts

During the operation of the proposed development there are potential impacts on VERs that are a result of the operation processes. These potential impacts can include:

- Air quality effects resulting from operational emissions (presented below) including nitrogen deposition and acidification.
- Habitat fragmentation due to increased road traffic.
- Disturbance from increased road traffic and operational activities.
- Disturbance effects resulting from increased noise and vibration.
- Water pollution from surface water drainage from roads, buildings and hard standing areas. Further information on the impacts associated with water quality is included in Section 7 of the Environmental Statement.
- Other forms of disturbance and pollution including noise and light from the operational processes.

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8 *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. J. Environ. Manage. 36: 253–286.*

9 *Hill, D., Hockin, D., Price, D., Tucker, G., Morris, R. & Treweek, J. 1997. Bird disturbance: improving the quality and utility of disturbance research. J. Appl. Ecol. 34: 275–288*

10 *Gill, J.A., Sutherland, W.J. & Watkinson, A.R. 1996. A method to quantify the effects of human disturbance on animal populations. J Appl Ecol 33: 786–792.*

13.5.3.1 Designated sites

Statutory designated sites are sited at least 1.5 km from the proposed development site and as such the only operational impact that they may be subject to are in relation air quality effects from the omissions of the development the assessment of these effects is presented in Section 13.5.4.1.

The proposed development will result in no change to any statutory sites and therefore any impacts are considered **not significant**.

The designated sites within 10 km of the proposed development are predominately designated for their ornithological interest. The impact upon the associated species is considered separately in the section on water birds, below.

13.5.3.2 Notable local habitats (Bran Sands Lagoon and Vopak Foreshore)

Operational impacts to locally notable habitats may occur in association with air quality and changes to water quality (as a result of drainage and/or discharge to the Tees).

The assessment of air quality effects is presented in Section 13.5.4. and has been concluded as of **negligible magnitude** and **not significant**.

Water quality impacts are discussed in more detail in Section 7. Effects on these notable habitats are expected to be of **negligible magnitude**, the choice of water cooling system requires no additional off-take from the Tees and only very limited discharge into the Tees.

Bird species associated with the designated sites described above are known to use these notable local habitats. The impact upon the associated species is considered separately in the section on water birds, below.

13.5.3.3 Species

13.5.3.3.1 Bats

Increased levels of lighting at the development site during the operational phase of the proposed development may have a negative indirect effect on individuals foraging offsite or commuting along the river corridor due to disruption of flight lines and increased risk if predation. Some bat species however use lighting as a positive effect for foraging (due to the lights attracting moths and other flying insects).

It is considered unlikely that the local area is used on a significant basis due to the lack of opportunity and the site's situation in a highly disturbed environment. In addition, the proposed development is cited adjacent to the existing industry and therefore there will be an increase in lighting levels only so far as an extension of lighting levels that already exists in the surrounding area.

The effects of this impact are assessed as being negligible and not **significant**.

13.5.3.3.2 Water birds

Operational impacts to breeding birds will be limited to indirect noise and visual disturbance to water birds utilizing offsite notable habitats (Bran Sands and Vopak Foreshore). Detailed information relating to noise effects is presented in Section 8. Birds generally show high tolerances to regular low level noise whilst occasional, loud noise is likely to be particularly disturbing. Much of the operational activities on site will be the former type of noise which will be required to conform to standards. In addition, the noise levels are expected to be comparable to other industry in the local area and will not significantly increase background levels. As such operational noise impacts to birds are considered of **negligible magnitude** and **not significant.**

TABLE 13.5
SUMMARY OF PRE-MITIGATION CONSTRUCTION AND OPERATIONAL IMPACTS

VER	Value	Type of Impact	Phase	Magnitude and extent of impacts	Confidence, duration and reversibility	Significance of impact
Statutory Sites	National	Not significant				
Locally Notable Habitats	Local-District	Not significant				
Bats	Local	Not significant				
Terrestrial Birds	Local	Habitat loss and displacement.	Construction	Permanent loss of breeding bird habitat	Certain, long term, irreversible	Significant at local level
Water Birds	National-International	Not significant				

13.5.4 Air quality effects

Section 6 of this ES describes the changes in air quality associated with the operation of the proposed plant and the methodology for the modelling exercise.

Technical Guidance Note AQTAG 06 requires that consideration be given to Natura 2000 sites (European designated ecology sites) within 10 km of plant of the type to be installed at the Teesport site. There is just one such site within 10 km of the site, the Teesmouth and Cleveland Coast SPA located at NZ569265.

In addition however to ensure a robust assessment is undertaken with regard to ecological interests in the area, nitrogen and sulphur deposition and eutrophication and acidification have also been assessed for the following SSSI:

- Tees and Hartlepool Foreshore and Wetlands;
- Lovell Hill Pools;
- Seaton Dunes and Common;
- South Gare and Coatham Sands;
- Seal Sands;
- Cowpen Marsh;
- Hartlepool Submerged Forest; and
- Redcar Rocks

All the above designations can be seen on Figure 13.2.

The European Community has set ambient air quality guidelines for nitrogen dioxide (NO_2), sulphur dioxide (SO_2) for the protection of ecosystems. A summary of the Directive is set out below in Table 13.6.

TABLE 13.6
EC AIR QUALITY STANDARDS
FOR THE PROTECTION OF VEGETATION/ECOSYSTEMS

Parameter	Reference period	Statutory ground level concentration limit values
Nitrogen dioxide	Annual	30 $\mu g/m^3$
Sulphur dioxide	Annual	20 $\mu g/m^3$

The Directive's limit values for the protection of vegetation and ecosystems will be treated as national objectives. They have not be included in regulations for the purposes of Local Air Quality Management (LAQM).

Nitrogen dioxide and nitric oxide are absorbed by vegetation. Their effects on plants are additive and the scientific consensus is that they should be treated together. Nitrogen is an essential plant nutrient and low exposure to nitrogen oxides can promote growth. However, higher exposures can cause adverse effects including leaf or needle damage and reduced growth. The point at which damage begins depends on the species, on its nutritional state and on other environmental factors. The United Nations Economic Commission for Europe (UNECE) and the World Health Organization (WHO) have developed a critical level at which the majority of species should be protected. This is an annual mean of 30 $\mu g/m^3$ (16 ppb) of nitrogen oxides. This has been adopted as a European limit value in the Air Quality Daughter Directive. The Government and the devolved administrations have decided that the Directive's annual limit value for the protection of vegetation of 30 $\mu g/m^3$ (16 ppb) NO_2 should also be included in the Strategy as a national objective to be achieved by 31 December

2000. This will enable the UK to comply with the limit value in the Directive. Preliminary indications suggest that policies currently in place should ensure compliance with this limit value.

It is important to define the areas in which the limit values are to be achieved. The Directive states that sampling points should be:

- at least 5 km from major emission sources; or
- 20 km from an agglomeration, which is defined as an area with a population of more than 250 000; and
- representative of areas of at least 1000 km^2.

The Government and devolved administrations intend that these objectives will apply in those parts of the UK that are:

- more than 20 km from an agglomeration; and
- more than 5 km away from industrial sources regulated under Part A of the 1990 Environment Act;
- more than 5 km from motorways; and
- built up areas of more than 5000 people.

Given the number of motorways and agglomeration in the vicinity of the proposed plant the EU limits do not apply, never the less these limits have been used to benchmark emissions from the proposed plant.

13.5.4.1 Existing environment at European sites

The Air Pollution Information Service provides information on the existing ground level concentrations, critical levels, critical loads and exceedences for sites in the UK. Table 13.7 shows the information for the various sites (or the closest point for which data is available).

TABLE 13.7
CRITICAL LOADS AND CRITICAL LEVELS AT THE ECOLOGICAL SITES (NO_2)

Site	Critical level of NO_x ($\mu g/m^3$)	NO_x concentration ($\mu g/m^3$)	Critical load of nitrogen (kg N/ha/year)	Nitrogen deposition (kg N/ha/year)
Teesmouth and Cleveland Coast SPA	30	25.5	10-20	14.4
Tees and Hartlepool Foreshore and Wetlands SSSI	30	19.7	10-20	14.0
Lovell Hill Pools SSSI	30	15.2	10-20	22.7
Seaton Dunes and Common SSSI	30	22.8	10-20	14.4
South Gare and Coatham Sands SSSI	30	31.5	10-20	15.3
Seal Sands SSSI	30	25.5	10-20	14.4
Cowpen Marsh SSSI	30	24.5	30-40	14.4
Hartlepool Submerged Forest SSSI	30	23.3	10-20	14.0
Redcar Rocks SSSI	30	24.3	10-15	18.6

The information in Table 13.7 indicates that the concentrations of NO_x are in some cases already exceeding the critical levels at the various site. It is also suggested that the critical load for nitrogen are exceeded for all the sites bar one. The corresponding information for levels of SO_2 are presented in Table 13.8.

TABLE 13.8
CRITICAL LOADS AND CRITICAL LEVELS AT THE ECOLOGICAL SITES (SO_2)

Site	Critical level of SO_2 ($\mu g/m^3$)	SO_2 concentration ($\mu g/m^3$)	Critical load of sulphur (kg/ha/year)	Sulphur deposition (kg/ha/year)
Teesmouth and Cleveland Coast SPA	20	4.5	4.0	1.45
Tees and Hartlepool Foreshore and Wetlands SSSI	20	8.5	1.5	1.68
Lovell Hill Pools SSSI	20	3.0	1.5	2.01
Seaton Dunes and Common SSSI	20	4.5	4.0	1.45
South Gare and Coatham Sands SSSI	20	3.5	4.0	1.46
Seal Sands SSSI	20	4.5	4.0	1.45
Cowpen Marsh SSSI	20	4.5	4.0	1.45
Hartlepool Submerged Forest SSSI	20	8.5	4.0	1.68
Redcar Rocks SSSI	20	3.0	1.5	1.84

* No information is available relating to the deposition of sulphur exclusively. This figure is therefore taken from the APIS data relating to total acid deposition and represents an extreme worst case.

The information in Table 13.8 shows that the concentrations of SO_2 well within the critical levels at the various site. However is also suggested that the critical load for sulphur are exceeded for all the sites by a considerable margin.

13.5.4.2 Modelling of air emissions from the REP

The modelling undertaken as part of the air quality assessment discussed in Section 6 also assessed the impacts to the European designated sites listed above.

The modelling has been assessed to determine the annual average contribution of the plant to NO_x and SO_2 concentrations at the designated sites. Modelling has assumed that the plant operates in isolation for 8760 hours per year at base load.

Technical Guidance Note AQTAG 06 outlines the approach required for assessment of impacts to European sites when undertaking dispersion modelling. The Guidance notes that provided that the width of the European site does not exceed 1.5 times the distance to the nearest edge of that site from the emission source that a single OS coordinate location (usually the closest to the proposed site) is sufficient to assess the impact to that site without the need for a more detailed study.

The proposed plant is located far enough away for a single OS co-ordinate location to suffice for the purposes of the assessment.

13.5.4.3 Critical levels

Critical levels for annual ground level concentrations of NO_x and SO_2 for the various ecological sites considered are as detailed above. These can be compared with the results of the dispersion modelling exercise to establish the likely impacts to the sites resulting from the proposed plant.

Table 13.9 below shows the predicted increments to the existing background levels identified by the Air Pollution Information System website for NO_x at the various designated sites due to operation of the proposed plant for the year 2003 established as generating the highest annual results in Section 6. It should be noted that this does not take into account any reductions as a result of the plant operating at lower output and assumes operation for 8760 hours per year.

TABLE 13.9
EXPECTED INCREMENTS TO GROUND LEVEL CONCENTRATIONS OF NO_2 AT THE ECOLOGICAL SITES
($\mu g/m^3$)

Site	Predicted concentration $\mu g/m^3$	Existing concentration $\mu g/m^3$	Total concentration $\mu g/m^3$	Predicted concentration as % of critical level $\mu g/m^3$	Total concentration as % of critical level $\mu g/m^3$
Teesmouth and Cleveland Coast SPA	0.11	25.5	25.6	0.3	85
Tees and Hartlepool Foreshore and Wetlands SSSI	0.37	19.7	20.0	1.2	67
Lovell Hill Pools SSSI	0.10	15.2	15.3	0.3	51
Seaton Dunes and Common SSSI	0.11	22.8	22.9	0.3	76
South Gare and Coatham Sands SSSI	0.17	31.5	31.7	0.7	105
Seal Sands SSSI	0.37	25.5	25.9	1.2	86
Cowpen Marsh SSSI	0.05	24.5	24.5	0.2	82
Hartlepool Submerged Forest SSSI	0.13	23.3	23.4	0.4	77
Redcar Rocks SSSI	0.20	24.3	24.5	0.7	81

The annual average increments to ground level concentrations of NO_x at the sites resulting from the Tees REP shown in Table 13.9 are all less than 0.4 $\mu g/m^3$. The plant is therefore considered not to have a significant impact on air quality at sensitive ecological sites. Concentrations at the various sites are predicted to exceed those proscribed by the EU in many cases however this is almost entirely associated with existing concentrations with the plant making a negligible contribution.

Table 13.10 below shows the expected increments to the existing background levels identified by the Air Pollution Information System (APIS) website for SO_2 at the various site due to operation of the proposed plant for the year 2003. It should again be noted that this does not take into account any reductions as a result of the plant operating at lower output and assumes operation for 8760 hours per year.

TABLE 13.10
EXPECTED INCREMENTS TO GROUND LEVEL CONCENTRATIONS OF SO_2 AT THE ECOLOGICAL SITES
($\mu g/m^3$)

Site	Predicted concentration $\mu g/m^3$	Existing concentration $\mu g/m^3$	Total concentration $\mu g/m^3$	Predicted concentration as % of critical level $\mu g/m^3$	Total concentration as % of critical level $\mu g/m^3$
Teesmouth and Cleveland Coast SPA	0.08	4.5	4.58	0.4	23
Tees and Hartlepool Foreshore and Wetlands SSSI	0.26	8.5	8.76	1.3	44
Lovell Hill Pools SSSI	0.07	3.0	3.07	0.4	15
Seaton Dunes and Common SSSI	0.08	4.5	4.58	0.2	23
South Gare and Coatham Sands SSSI	0.12	3.5	3.62	0.6	18
Seal Sands SSSI	0.26	4.5	4.76	1.3	23
Cowpen Marsh SSSI	0.04	4.5	4.54	0.2	23
Hartlepool Submerged Forest SSSI	0.10	8.5	8.60	0.5	43
Redcar Rocks SSSI	0.14	3.0	3.14	0.7	16

The annual average increments to ground level concentrations of SO_2 at the sites resulting from plant, as shown in Table 13.10 are insignificant being 0.1 $\mu g/m^3$ or less in all cases representing an insignificant contribution when compared to the EU limits for annual SO_2 concentrations for ecosystems.

It can be concluded that the plant does not have a significant impact on air quality at sensitive ecological sites in the area.

13.5.4.4 Effects of deposition of acidifying pollutants

As well as contributing to ambient concentrations of oxides of nitrogen, the emissions from the proposed plant have the potential to contribute to deposition of oxides of nitrogen and sulphur dioxide. Deposition of these and other acidic pollutants can be a concern as this can lead to acidification effects on the soils and ecosystems of environmentally sensitive sites. An assessment of the deposition effects of the proposed plant emissions has been made to confirm the contribution from the plant.

Dry deposition is calculated as follows. If the annual average ground level concentration of NO_2 or SO_2 is GC ($\mu g/m^{-3}$) and the dry deposition velocity is V_d (mm/s^{-1}) then the annual dry deposition rate D (keq/ha/yr) is calculated from the following:

$$D = V_d \times GC \times (C_1) \times 0.315 \times (C_2)$$
$$\qquad\qquad (a) \quad (b) \quad (c)$$

where

Where C_1 converts from NO_2 to N or SO_2 to S and is 14/46 and 32/64 respectively.

converts to kg/ha/yr

Where C_2 converts to keq/ha/yr and is 1/14 and 1/32 for N and S respectively.

The dry deposition velocity (V_d) of NO_2 and SO_2 has been set to 0.0015 ms^{-1} and 0.012 ms^{-1} respectively. This represents a worst case in the range for dry deposition of these pollutants as identified by the EA in Technical Guidance Note AQTAG 06.

The calculations for NO_2 assume an annual conversion of 100 per cent NO_x to NO_2 that, as discussed is a conservative estimate that will never be observed.

Technical Guidance Note AQTAG 06 requires that the applicant reports wet deposition at European sites. This is achieved by application of conversion ratios to the dry deposition results depending on the area in which the deposition is to occur. For the sites considered these conversion ratios are 2-3 for NO_2 and 1-1.5 for SO_2. This conversion has been applied assuming the worst case (upper conversion value) and are presented along side the dry deposition values for each of the 5 years modelled in Table 13.11.

TABLE 13.11
EXPECTED INCREMENTS TO N DEPOSITION AT THE ECOLOGICAL SITES

	Critical load (kg/ha/year)		Dry deposition (kg/ha/year)		Dry deposition as percentage of critical load		Wet deposition (kg/ha/year)		Wet deposition as percentage of critical load		Total deposition (kg/ha/year)		Total deposition as percentage of critical load	
site	**N***	**S****	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**	**N**	**S**
Teesmouth and Cleveland Coast SPA	10-20	4.0	0.002	0.0002	0.02	0.006	0.007	0.0003	0.03	0.009	0.010	0.0006	0.10	0.01
Tees and Hartlepool Foreshore and Wetlands SSSI	10-20	1.5	0.001	0.0004	0.01	0.032	0.005	0.0007	0.02	0.108	0.007	0.0012	0.07	0.08
Lovell Hill Pools SSSI	10-20	1.5	0.001	0.0001	0.01	0.011	0.004	0.0002	0.02	0.017	0.006	0.0004	0.06	0.02
Seaton Dunes and Common SSSI	10-20	4.0	0.002	0.0002	0.02	0.006	0.006	0.0003	0.03	0.009	0.008	0.0006	0.08	0.01
South Gare and Coatham Sands SSSI	10-20	4.0	0.003	0.0001	0.03	0.004	0.009	0.0002	0.04	0.007	0.012	0.0004	0.12	0.01
Seal Sands SSSI	10-20	4.0	0.002	0.0002	0.02	0.006	0.007	0.0003	0.03	0.009	0.010	0.0006	0.10	0.01
Cowpen Marsh SSSI	30-40	4.0	0.002	0.0002	0.00	0.006	0.007	0.0003	0.02	0.009	0.009	0.0006	0.03	0.01
Hartlepool Submerged Forest SSSI	10-20	4.0	0.002	0.0004	0.02	0.012	0.006	0.0007	0.03	0.018	0.009	0.0012	0.09	0.03
Redcar Rocks SSSI	10-15	1.5	0.002	0.0001	0.02	0.011	0.007	0.0002	0.07	0.017	0.009	0.0004	0.09	0.02

*To present a worst case it is assumed that the lower critical load value for N is relevant.

**Critical load assumed to be acid deposition as recorded by the APIS website in the absence of SO_2 specific data that is unavailable

13.5.4.5 Critical loads

In order to properly assess the impact of the results presented in Table 13.11 the predicted total deposition is presented in Table 13.12 and Table 13.13 along side the relevant critical loads for the various sites.

TABLE 13.12
EXPECTED CRITICAL LOADS OF N AT THE ECOLOGICAL SITES
(KEQ/ha/yr)

Site	Process contribution k_{eq}/ha/yr	Existing N load k_{eq}/ha/yr	Predicted load k_{eq}/ha/yr	Critical load k_{eq}/ha/yr	Predicted load as % of critical load
Teesmouth and Cleveland Coast SPA	0.010	14.4	14.410	10-20	144
Tees and Hartlepool Foreshore and Wetlands SSSI	0.007	14.0	14.007	10-20	141
Lovell Hill Pools SSSI	0.006	22.7	22.706	10-20	227
Seaton Dunes and Common SSSI	0.008	14.4	14.408	10-20	144
South Gare and Coatham Sands SSSI	0.012	15.3	15.312	10-20	153
Seal Sands SSSI	0.010	14.4	14.410	10-20	144
Cowpen Marsh SSSI	0.009	14.4	14.409	30-40	48
Hartlepool Submerged Forest SSSI	0.009	14.0	14.009	10-20	140
Redcar Rocks SSSI	0.009	18.6	18.609	10-15	186

Whilst Table 13.12 shows that nearly all critical loads are exceeded, it can clearly be seen the proposed plant makes an insignificant contribution to this and as such can be considered to be acceptable.

TABLE 13.13
EXPECTED CRITICAL LOADS OF S AT THE ECOLOGICAL SITES (KEQ/ha/yr)

Site	Process contribution k_{eq}/ha/yr	Existing acid load k_{eq}/ha/yr	Predicted environmental concentration k_{eq}/ha/yr	Critical load k_{eq}/ha/yr	Predicted load as % of critical load
Teesmouth and Cleveland Coast SPA	0.0006	1.45	1.4506	4.0	36
Tees and Hartlepool Foreshore and Wetlands SSSI	0.0012	1.68	1.6812	1.5	112
Lovell Hill Pools SSSI	0.0004	2.01	2.0104	1.5	134
Seaton Dunes and Common SSSI	0.0006	1.45	1.4506	4.0	36
South Gare and Coatham Sands SSSI	0.0004	1.46	1.4604	4.0	37
Seal Sands SSSI	0.0006	1.45	1.4506	4.0	36
Cowpen Marsh SSSI	0.0006	1.45	1.4506	4.0	36
Hartlepool Submerged Forest SSSI	0.0012	1.68	1.6812	4.0	42
Redcar Rocks SSSI	0.0004	1.84	1.8404	1.5	122

Table 13.13 shows that some critical loads are exceeded, however it can clearly be seen the proposed plant makes an insignificant contribution to this and as such can be considered to be acceptable.

13.6 Proposed mitigation measures

Within the context of Ecological Impact Assessment, mitigation is one of a hierarchy of measures that are undertaken to prevent or reduce adverse impacts:

- **Avoidance/prevention**: measures taken to avoid or prevent adverse impacts, eg scheme layout; timing of site works.
- **Reduction/mitigation**: measures taken to reduce adverse impacts, eg retaining walls; pollution interceptors.

- **Compensation/offsetting**: measures taken to offset significant residual adverse impacts, ie those that cannot be entirely avoided or mitigated to the point that they become insignificant: for example, habitat creation or enhancement.

In this section, specific mitigation measures are proposed for all significant ecological impacts on the habitats and species identified in the preceding sections. Generic mitigation measures are also proposed that include best practice methods and general principles that can be applied to the development as a whole, and are relevant to all habitats and species. As summarized in the opening paragraph, prevention or avoidance of these adverse impacts is the primary aim of ecological mitigation. If this is not possible measures would be proposed to reduce the impact and if this is also not possible then measures of offset the impact would be included in the mitigation strategy.

13.6.1 Generic mitigation to avoid impacts

The implementation of a Construction Environmental Management Plan (CEMP) by the appointed Contractor; and the development of a Works Method Statement to illustrate how impacts on ecology will be managed will be created. Good construction site management will be implemented to avoid/minimize generation of excessive litter, dust, noise and vibration. This will be controlled and monitored through the CEMP. Measures will be implemented to avoid/minimize potential for problems such as fuel and other chemical spills. There will be no storage of potentially contaminating materials in areas of hydrological sensitivity, eg in the vicinity of the Tees or the culverted drainage stream. A Pollution Incident Response Plan will be included as part of the CEMP to ensure that impacts from any potential accidental spills can be reduced to a minimum. In addition, the following measures should be included in the CEMP:

- ensure that work compounds and access tracks etc are not located in, or adjacent to, areas that maintain habitat value;
- establish site fencing to prevent access to areas outside working areas, particularly in areas adjacent to features of interest/value;
- implement procedures to cover site safety issues, including storage of potentially dangerous materials;
- provide briefings and instruction to contractors regarding the biodiversity issues present on the site; and
- follow pollution prevention guidelines provided by the Environment Agency (eg PPG01, PPG02, PPG03, PPG05 and PPG06) to prevent pollution of water courses from silt or chemicals.

13.6.2 Generic mitigation to reduce impacts

- Restrict workforce to working areas through the erection of fencing, to prevent additional damage;
- best practice methods would be followed throughout; and

- establish protocols and contingency plans for dealing with incidents should they arise.

13.6.3 Generic mitigation to offset impacts

Ensure all new landscape plantings in non-urban surroundings are comprised of native species, of local provenance, planned to complement the semi-natural habitats of the local area.

13.6.4 Mitigation of impacts to VERs

The potential impacts identified as a result of the proposed development are of local-negative significance.

Where potential exists for terrestrial breeding birds (scrub vegetation and buildings), removal or demolition will be undertaken outside the bird breeding season (March to late September inclusive for the majority of species) or alternatively, an ecologist will supervise the works.

Construction and operational lighting will, wherever possible, utilize low pressure sodium lamps or high pressure sodium instead of mercury or metal halide lamps. Lighting will be directed to where it is needed and light spillage avoided. This will be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only.

In addition to the above, off-site compensation in the local area will be implemented and this is considered to provide sufficient mitigation for the effects of the scheme and further, add net ecological gain. MGT will partner will other local industry and INCA in the area to re-establish intertidal habitat for a variety of species, including invertebrates and birds. MGT is currently investigating various opportunities that have recently been identified in the area for their suitability.

13.6.5 Assessment of residual effects

Table 13.14 summarizes the residual effects of the development proposals following the implementation of the mitigation measures outlined above.

TABLE 13.14
SUMMARY OF RESIDUAL EFFECTS POST-MITIGATION CONSTRUCTION AND OPERATIONAL IMPACTS

VER	Value	Type of Impact	Phase	Mitigation	Significance of impact
Terrestrial Birds	Local	Habitat loss and displacement.	Construction	Clearance of habitat outside breeding season Post development landscaping	Not significant

13.6.6 Assessment of cumulative impacts

Known development proposals in the local area include the construction of the Northern Gateway Container Terminal.

The ecological impact assessments of these development proposals have been reviewed and the impact assessment of the proposed development has been considered for potential cumulative effects. Based on the implementation of the mitigation activities proposed for the proposed development and for those proposed for the cumulative developments it is considered that there will be no further effects that require assessment and the assessment of residual effects of the proposed development presented in Table 13.14 are unlikely to change.

13.7 Conclusion

There is one internationally designated site and eight nationally designated sites (SSSIs) within 10 km of the proposed development site noted predominately for their intertidal communities and water birds. Neither the designated sites nor their associated species are considered to be significantly impacted upon by the proposed development.

Bran Sands and Vopak Foreshore are local (non-designated) sites of importance within 1.5 km of the proposed development. The sites are used by the protected and notable bird species associated with the surrounding designated sites. Neither the sites nor their associated species are considered to be significantly impacted upon by the proposed development.

Mitigation required to account for the ecological impacts of for the proposed development will be limited to ensuring general good construction practice and pollution prevention as well as timing of the construction works to protect terrestrial breeding birds. In addition, post-development compensation will provide net ecological gain through the re-establishment of intertidal habitat, which will be implemented in partnership with other local industry.

14. ARCHAEOLOGY AND CULTURAL HERITAGE

14.1 Summary

The area proposed for development covers 14 hectares, the majority of which comprises various dockside facilities. The area in which the study site lies is relatively low-lying land reclaimed from the River Tees since the late 19th century. The proposed site lies above sea level but nowhere does the land in the vicinity of the site rise above 10 m Above Ordnance Datum (AOD). Due to the method of its formation, the general topography of the Teesport Estate is generally flat or slightly undulating land, although there is some evidence of localized landscaping having been undertaken as part of, and subsequent to reclamation.

As part of the Environmental Impact Assessment a full archaeological desk based assessment (DBA) has been undertaken for the proposed site.

The assessment established that no statutorily protected archaeological or heritage site will be directly affected by the Project. In addition there are no listed buildings within the wider study area, so the development will have no impact on any such buildings or their settings.

When the archaeology of the site itself was considered it was identified that there was some potential for survival of palaeo-environmental and archaeological remains beneath the site. It was considered however that the remains would mostly be from the modern era and of negligible importance. This was due to the nature of the ground beneath the site which mostly comprises made ground reclaimed from the River Tees.

The DBA recommended that archaeological evaluation by trial trenching not be carried out within areas of proposed development impact. However, MGT Teesside will make available the results of geotechnical site investigations to an archaeological consultant or the archaeological development control section at Tees Archaeology and help devise a mitigation strategy for the Tees Renewable Energy Plant (Tees REP) development.

It is proposed than an archaeologist consultant be invited to site to inspect any major excavations. It is also proposed that Redcar and Cleveland Borough Council and English Heritage be kept fully informed of the plans for the project.

14.2 Introduction

This section presents an impact assessment of the proposed Tees REP on archaeology and cultural heritage. Details of the assessment methodology and significant criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

All significant potential impacts are discussed and proposed mitigation and management methods are detailed, where appropriate.

Cumulative impacts of the plant and other developments in the vicinity are also considered.

14.3 Assessment methodology and significance criteria

14.3.1 Relevant guidance

As a matter of best practice, the assessment has been undertaken based on relevant guidance regarding archaeology and cultural heritage assessment, as follows:

- *Standard and guidance for archaeological desk-based assessment* (Institute of Field Archaeologists (IFA), 2001);
- *Environmental Impact Assessment, A Guide to Procedures* (Department of the Environment, Transport and the Regions (DETR), 2000).

As described above, a formal scoping exercise has been undertaken to inform the scope of the EIA. That exercise concluded that no activities with the potential to disturb or damage the archaeological resource were anticipated to take place during construction or operation of the Project, thereby effectively 'scoping out' archaeology and cultural heritage from the EIA. However, it has subsequently been decided that archaeological and cultural heritage should be included within the scope of the EIA.

14.3.2 Methodology

The proposed Project site comprises part of the Teesport Estate, an industrial area on the south-west side of Tees Dock, this lying on the south side of the Tees, 6 km west of Redcar and 5 km east of Middlesbrough. Hereafter within this Chapter, the proposed Project site is referred to as 'the study site', for which the central National Grid Reference is NZ 54280 23180 (red-lined on Figures 14.1-14.25). A 'wider study area', defined as 2 km around the study site, was examined during the assessment to establish the potential nature, depth, preservation and importance of any palaeo-environmental and archaeological remains that could be present at the study site.

The known and potential archaeological and cultural heritage resource within the boundary of the study site and within the wider study area has been identified using information obtained from desk-based sources, augmented by a site visit. A site visit by Tees Archaeology was conducted on the 18 April 2008 to verify existing site conditions and assess potential setting issues associated with the built heritage and historic landscape components in and around the study site.

The archaeological resource may be previously designated by registration, listing or scheduling, or reported on national or local historic environment databases, including the National Monuments Record (NMR) and the Tees Archaeology Historic Environment Record (HER) (formerly known as the Sites and Monuments Record, HER). Previously unidentified resources can be identified scrutiny of landscape and historical records (both documentary and cartographic).

A detailed gazetteer of archaeological sites and find spots identified within and in the immediate vicinity of the wider study area is provided in Appendix K, with all HER entries being mapped on Figure 14.1 and referred to within Section 14.4.5 of this Chapter. Cross-referencing is by means of the HER number for each entry (in the text of Section 14.4.5, each entry is highlighted in bold, *eg* **HER 1234**). Where HER entries beyond the study area are mentioned, they are referred to simply by geographical location, without either HER reference or grid reference.

14.3.3 Significance criteria

14.3.3.1 Importance of the receptor

In assessing the effects of development proposals upon the historic environment, it is necessary to consider the importance of the resource (or 'receptor'), as well as the magnitude of impact. Determination of the importance of receptors (*eg* known or suspected archaeological sites, listed buildings, *etc.)* is based upon existing designations, whilst professional judgements and a degree of flexibility are inherent in the assessment process in the case of undesignated receptors. Criteria used in the determination of importance are set out below in Tables 14.1a and 14.1b**,** for archaeological sites and the built heritage, respectively:

TABLE 14.1a
CRITERIA USED TO DETERMINE IMPORTANCE OF ARCHAEOLOGICAL RECEPTORS

Importance	Description
International	Archaeological Sites or Monuments of International importance, including World Heritage Sites.
National	Ancient Monuments scheduled under the Ancient Monuments and Archaeological Areas Act 1979, or archaeological sites and remains of comparable quality, assessed with reference to the Secretary of State's non-statutory criteria (these are set out in PPG16, Annex 4).
Regional	Archaeological sites and remains which, while not of national importance, fulfil several of the Secretary of State's criteria and are important remains in their regional context.
Local	Archaeological sites and remains that are of low potential or minor importance.
Negligible	Areas in which investigative techniques have produced negative or minimal evidence for archaeological remains, or where previous large-scale disturbance or removal of deposits can be demonstrated.

TABLE 14.1b
CRITERIA USED TO DETERMINE IMPORTANCE OF BUILT HERITAGE RECEPTORS

Importance	Description
International	• World Heritage Sites • Buildings of recognized international importance
National	• Scheduled ancient monuments which include buildings • Grade I and II* listed buildings • Other listed buildings which are shown to have exceptional qualities • Conservation Areas containing very important buildings • Undesignated structures of clear national importance
Regional	• Grade II listed buildings • Unlisted historic buildings shown to have exceptional qualities • Conservation areas containing important buildings • Historic townscape or built-up areas with historic integrity in their buildings or built settings • Registered Historic Parks and Gardens
Local	• Locally listed buildings • Undesignated historic buildings of moderate quality • Historic townscapes or built-up area of limited historic integrity in their buildings or built settings
Negligible	• Buildings of no architectural or historic interest • Buildings of an intrusive character
Unknown	• Buildings of some hidden potential for historic significance

14.3.3.2 Types of impact

Impacts upon cultural heritage resources are predominantly permanent adverse impacts resulting from the loss of elements of the resource as a result of construction activities. Occasionally there may be temporary adverse impacts - those that persist for a limited period only - for example, when the overall setting of a site or monument is affected by noise from construction activities, while more often there are permanent adverse impacts - those that result from an irreversible change to the baseline resource or which persist long–term - when sites themselves are affected by new development. With regard to the historic built environment, well-designed development can result in permanent beneficial impacts where the setting of a historic building is enhanced.

Impacts upon cultural heritage resources may be short term or long term and include:

- **Direct impacts** – tangible, usually site specific, physical impacts, for example demolition of a building or removal of archaeological remains through

groundworks. In cultural heritage terms, direct impacts are almost always permanent.

- **Indirect impacts** – these do not usually physically affect the resource, but may alter its setting or utility. Examples of indirect impacts include visually intrusive structures or the restoration of views. The effects of noise and light pollution are also indirect impacts. In some cases indirect impacts may physically affect the archaeological resource, such as contamination of buried remains as a result of accidental spillages of pollutants, alterations to hydrological regimes, or alterations required to historic buildings, *eg* double glazing to mitigate increased noise levels.

- **Cumulative impacts** - where the cumulative effect of multiple impacts produces a greater collective effect, such as on the 'group value' of individual resources or on the character of a wider historic landscape, or the degradation of a single resource as a result of multiple impacts.

- **Positive impacts** – where there is an increase in knowledge resulting from the recording and analysis of archaeological sites and/or historic buildings, or where there is potential to improve the setting and amenity of the historic environment, or an opportunity to inform and involve local business and residential communities regarding their historic environment.

14.3.3.3 Assessment of impact significance

The determination of magnitude of impact is based upon an understanding of how and to what extent the proposed development would impact upon the receptors (see Table 14.2).

TABLE 14.2
CRITERIA USED TO DETERMINE MAGNITUDE OF CHANGE

Magnitude	Impact
High Adverse	Complete removal of an archaeological site. Severe transformation of the setting or context of an archaeological monument or significant loss of key components in a monument group. Complete removal or transformation (*eg* desiccation or contamination) of palaeo-environmental deposits leading to complete loss of research knowledge.
Medium Adverse	Removal of a major part of an archaeological site's area and loss of research potential. Partial transformation of the setting or context of an archaeological site or partial loss of key components in a monument group. Partial removal or transformation of palaeo-environmental deposits leading to a loss of research knowledge. Introduction of significant noise or vibration levels to an archaeological monument leading to changes to amenity use or, accessibility or appreciation of an archaeological site. Diminished capacity for understanding or appreciation (context) of an archaeological site.
Slight Adverse	Removal of an archaeological site where a minor part of its total area is removed but that the site retains a significant research potential. Minor change to the setting of an archaeological monument. Minor removal of palaeo-environmental deposits that form part of a wider surviving research resource.

Magnitude	Impact
Negligible	No physical impact or change. No observable change in setting or context. No impact from changes in use, amenity or access.
Slight Beneficial	Decrease in visual or noise intrusion on the setting of an archaeological site or monument. Improvement of the wider landscape setting of an archaeological site or monument.
Medium Beneficial	Significant reduction or removal of visual or noise intrusion on the setting of an archaeological site or monument. Reduction or removal of significant vibration levels. Improvement of the setting of an archaeological site or monument. Enhanced capacity for understanding or appreciation (context) of an archaeological site or monument. Improvement of the cultural heritage amenity, access or use of an archaeological site or monument.
High Beneficial	Exceptional enhancement of an archaeological site, its cultural heritage amenity and access or use.
Uncertain	The magnitude of the impact cannot be predicted.

Significance of environmental impacts

The significance of the effects of the proposed development on archaeological remains is determined by:

- the importance of the receptor; and
- the magnitude of change.

Table 14.3 provides a matrix to demonstrate how the significance of effect is assessed.

TABLE 14.3
MATRIX FOR ASSESSMENT OF SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

Impact		Adverse				Beneficial		
		High	**Medium**	**Low**	**Negligible**	**Low**	**Medium**	**High**
Importance	International Importance	High Adverse	Moderate Adverse	Slight Adverse	Neutral	Slight Beneficial	Moderate Beneficial	High Beneficial
	National Importance	High Adverse	Moderate Adverse	Slight Adverse	Neutral	Slight Beneficial	Moderate Beneficial	High Beneficial
	Regional Importance	Moderate Adverse	Slight Adverse	Slight Adverse	Neutral	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
	Local Importance	Slight Adverse	Slight Adverse	Neutral	Neutral	Neutral	Slight Beneficial	Slight Beneficial
	Negligible	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral

14.4 Baseline conditions and receptors

14.4.1 Statutory constraints

There are **no** scheduled monuments within the study site, or within the 2 km radius wider study area.

There are **no** listed buildings within the study site or within the 2 km radius wider study area.

The study site does **not** lie within a conservation area, however there are such areas within the 2 km radius wider study area.

14.4.2 Site location

The study site, centred on central National Grid Reference NZ 54280 23180, is an industrial dockside area within the Teesport Estate on the north-eastern margin of Middlesbrough. The existing south bank of the Tees is land reclaimed from the Tees Estuary since the late 19th century, now lying within the administrative boundary of Redcar and Cleveland Borough Council. The study site is bounded to the north by the River Tees, to the north-east by the quayside of Tees Dock, to the south by open ground and to the south-west by land within the curtilage of the steel-making facility operated by Corus. To the west of the proposed site is a tank farm owned by Sabic. There are a series of pipelines associated with the tank farm that run around the perimeter of the site.

14.4.3 Site description and topography

The site was visited in April 2008 in order to locate and record any landscape features, to identify undesignated buildings of historic interest and to assess previous development impact on the site and potential development impacts on the archaeological and cultural heritage resource.

The area proposed for development covers *c.* 14 hectares, the majority of which comprises various dockside facilities. The north-easternmost portion of the site, on the south-western quayside of Tees Dock, comprises a substantial warehouse (the Steel Export Terminal warehouse). The works in the steel framed warehouse are now undertaken on the adjacent quay, making the building redundant. Prior to this project's works commencing, the warehouse will be dismantled and its land area leased to MGT. The south-westernmost portion of the site, adjacent to the Corus works, is occupied by a tank farm from which a series of suspended pipelines emanate. Apart from a group of small, low-level buildings – mostly administrative buildings, offices and the like - on the south-eastern margin of the site, there are no other structures on the study site. Extensive dockyards and open storage areas, with several access roads, form the majority of the ground at the site, with the southernmost extension to the proposed development area occupying an area of waste ground.

The area in which the study site lies is relatively low-lying land reclaimed from the River Tees since the late 19th century. It lies above sea level but nowhere does the land in the vicinity of the site rise above 10 m Above Ordnance Datum (AOD). Due to the method of its formation, the general topography of the Teesport Estate is generally flat or slightly undulating land, although there is some evidence of localized landscaping having been undertaken as part of, and subsequent to reclamation. Inland to the east, the ground rises, from *c.* 10-30 m AOD across the area occupied by some of Teesside's most extensive industrial premises, including the ICI chemical plant at Wilton, with Grangetown and South Bank, the peripheral residential parts of Middlesbrough, immediately to the

south-west. To the south-east of the urban area, beyond the A174, lie the Eston Hills, the northern outliers of the Cleveland Hills, with the ground rising to more than 200m AOD, this *c.* 5 km beyond the study site.

14.4.4 Geological background

The solid geology of the Teesport Estate area comprises strata of the Mercia Mudstone Group, generally red and yellow mudstones with some layers of sandstone, these varying in thickness from *c.* 10 m in the west to *c.* 30 m in the east. The basal beds of the Mercia Mudstone Group, the Seaton Carew Formation, are known to overlie the Sherwood Sandstone Group, typified by strata of weakly cemented fine to medium grained sandstone, which can reach thicknesses in excess of 200 m (British Geological Survey, 1987).

Glacial Till has previously been recorded by boreholing in the Teesport Estate (Mouchel Parkman, 2006), such material being the earliest – in stratigraphic terms - element of the drift geology of the area. Described as 'stiff reddish brown and grey boulder clay with occasional sand pockets', such material has been identified at depths varying between *c.* 3 m and *c.* 10 m and with an overall thickness of *c*. 6.50 m to *c.* 20 m. The stratigraphically latest geological strata known in the area of the Teesport Estate is estuarine marine Alluvium of post-glacial origin. Also recorded by boreholing, when it was described as 'soft greyish brown, slightly organic, very silty clay with brown sand pockets, occasional wood fragments and occasional pockets of organic material', such material has been encountered at depths varying between *c.* 6.40 m and *c.* 20.75 m, with its recorded thickness varying from *c.* 2.75 m to *c.* 5.50 m.

Natural Alluvium in the vicinity of the study site is typically overlain by 'made ground' of various compositions, such material having been dumped on the former margins of the River Tees during the process of land reclamation from the late 19th century onwards. Land reclamation in the Tees Estuary typically involved the creation of an extensive artificial river bank on the estuarine mudflats using boulders, river cobbles and iron working residues or 'slag', mounded into a bund, and standing well above the high water mark, with the landward area then infilled with 'made ground'. Boreholing elsewhere on the Teesport Estate has recorded two distinct types of 'made ground' (Mouchel Parkman, 2006). Typically the lowermost material is described a 'hydraulic fill', generally 'loose black sandy silt', this being material obtained from dredging of the river following canalization of the river channels. The thickness of such material as recorded has varied from *c.* 1.50 m to *c.* 15.0 m and it has been encountered at existing ground level, but also at depths of *c.* 6.50 m. The uppermost type of 'made ground' recorded by boreholing in the vicinity is iron working residue or 'slag', varying in thickness from *c.* 0.80 m and *c.* 3.0 m.

14.4.5 Archaeological and historical baseline

Prehistoric and historic timescales

Timescales referred to in this section are:

Prehistory

Palaeolithic	450,000–12,000 BC
Mesolithic	12,000–4,000 BC
Neolithic	4,000–2,300 BC
Bronze Age	2,300–700 BC
Iron Age	700 BC–AD 43

Historic

Roman	AD 43–410
Anglo-Saxon	AD 410–1066
Medieval	AD 1066–1485
Post-medieval	AD 1486–AD 1830
Industrial	AD 1830-AD 1900
Modern	AD 1900-present

Prehistory

There are no known prehistoric sites at the study site and no finds from the various prehistoric eras have been collected from within its boundaries. There are no HER entries in the wider study area that could indicate prehistoric activity along this part of the southern margin of the Tees estuary.

Beyond the wider study area, the HER lists a Neolithic stone axe head, recovered in 1892 during dredging in the mouth of the Tees. Several kilometres further north, peat deposits underlying Hartlepool Bay have yielded significant archaeological evidence, initially as casual finds as the peat beds were exposed by tidal erosion and, since the 1980s, through a series of targeted interventions (Waughman, 2005). In addition, the importance of inter-tidal organic wetland deposits to the study of sea level and palaeo-environmental change has long been acknowledged and, in recognition of this, *c*. 20 hectares of the beach in Hartlepool Bay were designated a Site of Special Scientific Interest (SSSI), 'Hartlepool Submerged Forest', in 1988. In sum, work in and around Hartlepool Bay has revealed that sea levels rose rapidly during the Mesolithic period, with subsequent fluctuations during the Neolithic period and Bronze Age before generally higher sea levels during the Iron Age. Pollen evidence from Hartlepool Bay has recorded vegetation from before 7000 to 2000 BP and has revealed episodes of land clearance, becoming increasingly intense during the Neolithic, but in particularly from the Late Bronze Age onwards. Such agricultural intensity is represented by the increasing presence of cereal types in the pollen record.

Bronze Age activity is well known on and around the Eston Hills, *c*. 5 km south-east of the study site. This period saw, as indicated above, extensive woodland clearance until *c.* 1400 BC, with numerous

farmsteads established and field systems set out (Tees Archaeology website). Numerous round barrows were constructed, these to serve as religious monuments in which highest status members of the society were buried, as well as territorial markers, defining tribal boundaries. The large number of such burial mounds on the Hills suggests a relatively high population in the area at the time.

By the Late Bronze Age/Early Iron Age, farming had expanded all over the Eston Hills to cope with an increasing population and more extensive field systems were developed and defended settlements were established (Tees Archaeology website). Eston Nab, at 242 m AOD the highest point on the Hills, was the site of one such settlement. The remains of a Bronze Age palisade have been identified on the highest point of the site, with traces of roundhouses identified within the enclosure. In the mid 5th century BC, the site was enlarged and banked defences were constructed, these still visible today. It has been suggested that intensive cultivation of the Hills led to so much erosion so that the farmers were forced to move their farmsteads onto the heavier clay soils of the Tees Lowlands. In 1990, an Iron Age farmstead was discovered by aerial photography at Foxrush Farm, on the marshland margin of the Tees Estuary, this *c.* 4.5 km due east of the study site. Since then, the site at Foxrush Farm has been subject to a series of archaeological excavations, mostly investigating the settlement boundary ditch and several roundhouse dwellings, but encountering important evidence of salt production and metal working in the process.

It is largely uncertain whether or not, due to reduced sea levels, the area of the study site could have been relatively dry, albeit intertidal, land, to allow any form of human activity during any prehistoric era (with the Neolithic and Early Bronze Age arguably being the most suitable candidates). Subsequent siltation resulting from sea level rise could conceivably have overlain and thereby preserved any prehistoric land surfaces, including any archaeological and or palaeo-environmental evidence associated with them. A more significant factor, however, is the potential for activity and development within the Tees Estuary during and since the industrial era to have disturbed and/or overlain earlier archaeological land surfaces.

Roman

There are no known Roman sites at the study site and no finds from this period have been collected within its boundaries.

There no HER entries in the wider study area to indicate any Roman period activity along this part of the southern margin of the Tees estuary. The north-eastern part of the urban area of Middlesbrough and the Teesmouth area in general have produced little evidence of Roman period activity. It is conceivable, however, that vessels used the Tees for ship borne trade during the Roman period.

Saxon and medieval

There are no known Anglo-Saxon or medieval sites at the study site and no finds from these periods have been collected within its boundaries.

There no HER entries in the wider study area to indicate any Anglo-Saxon or medieval period activity along this part of the southern margin of the Tees Estuary. Just beyond the wider study area, *c.* 2.5 km to the north-east of the study site, an object identified as an early medieval spearhead, with

remains of a wooden shaft within its closed socket, was found in the 1930s on a slag tip on the site of former blast furnace.

The River Tees, as well as its intertidal and inland margins, would certainly been in use during the medieval period. The following summary of the various manors which held land east of the Tees between Middlesbrough and Teesmouth is taken from the Victoria County History (Page, 1923). Although there is no mention of Middlesbrough – by that name – in the Domesday Survey of 1086, the area of the town was probably included in the manor of Acklam. Down to the 16th century much of the land in the area of the town belonged to Guisborough Priory, which, along with Byland Abbey, is recorded as owning fisheries in the River Tees during the medieval period. To the east were the manors of Ormesby and Ormesby Grange with, to the north, the manors of Eston, Lazenby and Lackenby, all recorded by the Domesday Survey. On the coast, east of Teesmouth, was the manor of East Coatham, this first documented in 1257 and previously part of the manor of Kirkleatham, this mentioned in the Domesday Survey as 'Westlidun'. Of some importance in the 12th and 13th centuries, the port village of Coatham has now been subsumed into the town of Redcar. Adjacent to the Tees was the distinct manor of West Coatham, first mentioned in documentary sources in 1236-39, and which had become part of the manor of Wilton by the early 15th century.

The medieval population in the vicinity of the study site, working out of villages and hamlets such as Kirkleatham, West Coatham, Lackenby, Ormesby and Eston, would have certainly utilized the natural resources of the Tees Estuary. While the study site would have occupied estuarine mud flats at this time, documentary evidence indicates significant usage of the adjacent inland salt marshes, from the 12th through to the 15th centuries, with Kirkleatham, West Coatham and Coatham Marsh all mentioned in relation to salt-working. For example, a late 12th century document records that Roger, son of William de Tocketts, gave a salt-pan in 'Cotum' to Guisborough Priory (Page, 1923). Just beyond the wider study area, *c.* 2.5-3.0 km east of the study site, a cluster of HER entries relate to former salt mounds on marshland at West Coatham. Shown on the 1st edition of Ordnance Survey map from the mid 19th century, the period of origin of these features – none of which survive today - is uncertain.

As with potential activity of prehistoric date, it is largely uncertain whether or not any form of medieval activity would have been possible at what would have been an extremely hostile intertidal location occupied by the study site during the Middle Ages. Once again, the potential for activity and development within the Tees Estuary, during and since the industrial era, to have disturbed and/or overlain earlier land surfaces, must be considered.

Post-medieval and industrial

There are no known post-medieval or industrial era sites at the study site and no finds from these eras have been collected within its boundaries.

There are numerous HER entries in the wider study area – discussed in the following paragraphs and mapped on Figure 14.1) which reflect how land along the southern margin of the Tees Estuary was made available primarily for industrial use through large-scale reclamation during the 19th century.

The River Tees was mapped from the late 16th century onwards, initially as result of the production of practical charts for mariners. A collection of historic maps and charts, '*The History of the River Tees*

in Maps (Cleveland and Teesside Local History Society, no date) contains detailed information regarding the development of the area of the study site and is acknowledged as the source of elements of the following summary.

The first printed sea atlas showing the British coast, produced in 1584, contained a chart of the North-East coast including the Tees Estuary, by the Dutch cartographer Lucas Janszoon Waghenaer (Figure 14.2). While this chart is too schematic and of too small a scale to show the area of the study site in detail, the settlement at Redcar is shown, with a windmill and an unnamed settlement further west along the south side of the broad Tees Estuary. It is recorded that, from 1666, the Turner family of Kirkleatham held all rights to anchorage and groundage dues from shipping along the coast from Redcar to Cargo Fleet, an early port facility (sometimes called Cleveland Port) to the east of the area that would become the town of Middlesbrough. Joseph Dobson's 1762 chart of Teesmouth clearly demonstrates the intertidal nature of the area at the time and is in sufficient detail to be able to gauge the approximate location of the study site (Figure 14.3). The coastal settlements at Redcar and Coatham are shown, and other named features are 'Tod Point', 'Dab Holm' (a low lying point where sloops could moor at low water to allow their cargo to be taken ashore and which gave its name to an estuarine beck that discharged into the Tees), and the port facility at Cargo Fleet. Also much in evidence are the extensive estuarine sand bars, 'Seal Sand' and 'Bran Sand'.

Land reclamation on the south side of the Tees Estuary was undoubtedly a concern for local landowners during the 18th century and a plan made by John Mowbray in 1779 (not reproduced herein) in connection with a legal dispute between the owners of the manors of Kirkleatham and Wilton showed embankments made by the Lowther family of Wilton in the 1720s to prevent high tides overflowing West Coatham Marsh so that it could be used for pasture. In 1777, Sir James Lowther began extensive but what were ultimately unsuccessful attempts to reclaim large areas of the marshland adjacent to the estuary.

Middlesbrough remained a very small settlement area throughout most of the post-medieval period. Even at the beginning of the 19th century the township was a *'dreary and swampy expanse'*, with a ruined church and just 25 inhabitants occupying a handful of farmsteads and (Page, 1923). It was the extension of the Stockton and Darlington Railway (S&DR) in 1828 to the Middlesbrough side of the Tees, which proved the catalyst for the expansion of the town. A group of Quaker businessmen realized the value of such riverside ground as the site of a new coaling port and purchased 500 acres on which to erect staithes and set out an associated residential area for workers. The purchasers, who styled themselves the 'Middlesbrough Owners', were Thomas Richardson, Henry Birkbeck, Simon Martin, Joseph Pease Jr., Edward Pease and Francis Gibson. The first of many ships loaded with coal left Middlesbrough and passed out to sea in 1830. The local clay afforded excellent material for building and streets radiating from a large square space designed as a market-place soon spread over the adjacent vacant ground.

The population of Middlesbrough was 154 in 1831, an increase directly attributed to the extension of the S&DR. By 1841, with the newly made town in place, the population was more than 5,000. The 'Middlesbrough Improvement Act 1841' appointed commissioners to provide for the lighting, watching and cleansing of the streets and the general improvement of the town. A map drawn by Henry Cross in 1843 (Figure 14.4) shows the railway entering the town and although the Tees is shown at high tide, with the area of the study site underwater, it is of interest as it shows all the previously discussed ancient settlements south of the Tees between Middlesbrough and Redcar, prior to late 19th century

industrialization of the area. The railway is also shown on slightly later charts from 1849 and 1857 (Figures 14. 5 and 14.6, respectively) by which time the line had been extended up to Redcar on the coast; the Middlesbrough and Redcar Railway (M&RR) was allowed by an 1845 Act of Parliament and was amalgamated into the S&DR in 1858.

Of great concern to Teesside businessmen in the late 18th and early 19th century was the state of the River Tees, with its hazardous braided course through the sand banks of Teesmouth and its meandering natural course inland towards Stockton. In 1791 a proposal was made to construct a 'cut' across the meander of the river at Mandale near Stockton. In 1810, the Tees Navigation Company (TNC) completed the 220 yard long Mandale Cut - saving a distance of two and a half miles - and the Portrack Cut followed in 1831, this covering 1100 yards and cutting across another meander at Portrack, again towards Stockton.

With much decreased journey time along the Tees, and a resultant increase in traffic volume, improved navigational aids became imperative. Since the 16th century Trinity House had maintained buoys in Teesmouth and up the river as far as the 'Ninth Buoy', situated on the south side of the river, to the north-east of the study site (shown on Figure 14.5). The aforementioned TNC had been empowered since its foundation in the early years of the 19th century to light and buoy the river and to levy light duties, although it was not until 1839 that these powers were exercised. Leading lights were erected at Redcar Rocks and on Bran Sand and further lights were added in 1842 to allow safe passage along the treacherous route as far inland as Cargo Fleet. The chart drawn up in 1849 by James Johnson for the TNC (Figure 14.5) shows a series of lighted buoys along the deepwater channels to facilitate safe navigation by night, and this chart, as well as a chart drawn in 1857 (Figure 14.6) show the study site on the north-western edge of the estuarine sand and mud banks immediately adjacent to the deepwater 'South Channel'. A group of 'Stone Beacons' is annotated in the immediate vicinity of the easternmost portion of the study site on the 1849 chart. Further improvement to navigation of the Tees in the vicinity of the study site came in the 1850s following the founding - in 1852 - of the Tees Conservancy Commission (TCC) to help look after the interests of all river and port users. Significant works were undertaken which resulted in the closure of the North Channel so that water flow was entirely canalized through the South Channel, south of Middle Sand, immediately to the north-west of the study site. Dredging of the river in the 1970s produced a stoneware flagon of likely post-medieval date in the vicinity of the study site (Figure 14.1, **HER 651**).

The 1840s saw Henry Bolckow and John Vaughan found Middlesbrough's most important industry, with ironworks established to manufacture various kinds of steel and wrought-iron. By 1850, work had begun began to mine rich deposits of ironstone in the Cleveland Hills, from Eston to Kirkleatham. The first blast furnaces were built in Middlesbrough soon afterwards and a cluster of such structures appears on the 1857 chart (Figure 14.6), along the railway corridor to the south of the study site. The furnaces thus depicted probably relate to early elements of works represented by a group of HER entries located towards the southern limit of the wider study area (all on Figure 14.1): Clay Lane Iron Works (**HER 5619**), South Bank Iron Works (**HER 5625**), Eston Iron Works (**HER 5629**), an unnamed iron works (**HER 5631**), an unnamed steel works (**HER 5633**), Lackenby Iron Works (**HER 5659)** and an associated reservoir (**HER 5658**). By 1900, Eston Iron Works had expanded to become Cleveland Iron Works and it was through these works – and the other such manufactories in and around the town - that production of pig-iron rapidly increased in the second half of the 19th century, until, by 1900, Middlesbrough produced one-third of the total output of Great Britain.

On the 1st edition (6 inches to 1 mile) Ordnance Survey map from 1857 (Figure 14.7) the study site is shown, along with all land north of the M&RR, within the River Tees. Beacons and buoys marking the navigable channel through the estuary in the vicinity of the study site are annotated. To the south, running along the edge of the higher ground skirting the estuary, the railway line overlooks a strip of land annotated 'as 'liable to be flooded', with the 'High Water Mark of Ordinary Spring Tides' marked beyond that. Landward of the railway, the 1st edition shows what is still essentially an agricultural landscape, with just the beginnings of industrialization evident along the railway corridor between Middlesbrough and Coatham/Redcar. On the southern limit of the wider study area the 1st edition map shows the aforementioned Eston Iron Works (Figure 14.1, **HER 5629**), associated workers' housing (a terrace named 'Furnace Row') (Figure 14.1, **HER 5627**) and the Eston Branch Railway (Figure 14.1, **HER 5626**), opened in 1851 as a private line for Bolckow and Vaughan's mining operations and diverting from the M&RR at Eston Junction Station (Figure 14.1, **HER 4358**). Also within the wider study area, other stations were added to the line at Eston Grange (later renamed Grangetown) (Figure 14.1**, HER 4360**) and Lackenby (Figure 14.1, **HER 5647**) during the second half of the 19th century.

Concerned specifically with the River Tees rather than adjacent land use, two charts compiled in 1878 and 1881 by John Fowler for the TCC (Figures 14.8 and 14.9, respectively) are of more immediate relevance to the study site. Such charts provide important information regarding the mechanics of regulation of the Tees in the second half of the 19th century. By *c.* 1880, half-tide 'training' walls had been completed along parts of the south bank of the Tees, with an curvilinear embankment to mark the high water line raised further inland; landward of this embankment the land is annotated as 'reclaimed' on the 1881 chart. This chart also shows the 'South Gare Breakwater' almost completed at the mouth of the river. Detailed construction information is recorded for this, some of which is worthy of note since the training walls in the vicinity of the study site are likely to have been raised using similar materials. Work started on South Gare Breakwater in 1861 but it was not fully completed before its official opening until 1888; it is recorded as having comprised a 8 km long embankment of broken iron slag, a 730 m long breakwater of slag balls and a *c.* 1 km long concrete breakwater backed by slag blocks, with the head of the structure protected by a circle of 4.9 m cube concrete blocks each weighing 200-300 tonnes. Since Cleveland Ironstone has a very low iron content, large quantities of slag were produced in local iron works, so that the local Ironmasters were willing to pay the TCC to haul slag up the Redcar railway line for use in the construction of the breakwater. Following erection of the training walls, the river channels were intensively dredged and the silts removed were used to reclaim the foreshore (Rowe, 1999).

It is likely that most, if not all, new river walls raised along the Tees in the second half of the 19th century were originally constructed from similar materials as the South Gare Breakwater, with iron slag being in plentiful supply. The portion of the river wall (Figure 14.1, **HER 6046**) between Eston Wharf Mooring Stage (Figure 14.1, **HER 5613**) in the south-west and South Gare Breakwater, contains the section that skirts the study site and this appears on all mapping subsequent to the TCC charts from *c.* 1880. The HER lists a series of 19th century beacons associated with the early river wall and reclaimed foreshore (Figure 14.1, **HER 6048-6055, 6064-6065**), as well as more prominent navigation lights, such as the Eight Buoy Scarp Beacon (Figure 14.1, **HER 6056**) and the Ninth Buoy Front and Back Lights, these immediately to the north-east of the study site, where Tees Dock now stands (Figure 14.1, **HER 6047** and **6063,** respectively). Other industrial era riverfront facilities within the wider study area and listed in the HER are (all shown on Figure 14.1**)**: Clay Lane Jetty and Wharf (**HER 5608** and **5609**); the aforementioned Eston Wharf and Jetty (**HER 5610** and **5612**) and a

Customs House (**HER 5611**). Opposite the study site, adjacent to the north bank of the Tees following its canalization, a floating hospital ship (Figure 14.1, **HER 2812**) was moored between 1885 and World War I. Used to treat arriving seamen with infectious diseases, it was sold in 1917 after being used since the war as Royal Navy accommodation.

Other industrial era HER entries in the wider study area (all shown on Figure 14.1) reflect the broad nature of late 19th century industrialization of the south bank of the Tees. For example: *c.* 1 km south of the study site was a phosphate manure works (**HER 5624**), this linked to the aforementioned South Bank Iron Works; just to the east was a small gasworks (**HER 5628**); clay and brickearth pits (**HER 5646** and **HER 5649**, respectively) formerly existed close to Lackenby Station, *c.* 1.5 km to the south-east of the study site; these in the vicinity of a brick yard (**HER 5653**), which was replaced by a concrete works before 1895 (**HER 5654**). Most of these sites have been identified from scrutiny of the 1st and 2nd editions of the Ordnance Survey map, from 1857 and *c.* 1895, respectively. The 2nd edition (6 inches to 1 mile) for North Yorkshire (Figure 14.10) shows the study site adjacent to the new river wall on an expanse of mud flats, not yet reclaimed at that date, and notable for the presence of numerous braided creeks flowing into the Tees. To the south-east, the land between the railway line and the high water line embankment shown on the 1881 chart has been reclaimed and put to a variety of uses. On the southern limit of the wider study area, the expanded Cleveland Iron Works in the railway corridor. The Teesside chemical industry started relatively late in comparison to its iron and steel industries, and the aforementioned phosphate manure works represents a manufactory of chemical fertilizer (an 1830s works near Yarm is the earliest known in the area). It was the discovery, *c.* 1860 of rock salt while boring for water below the Eston Iron Works of Bolckow and Vaughan Co. Limited that proved the first major catalyst for the growth of the Teesside chemical industry.

Modern

There are no known modern era archaeological sites at the study site and no finds from this era have been collected within its boundaries.

A handful of HER entries in the wider study area are indicative of continued development and usage of the industrialized southern margin of the Tees Estuary during the modern era.

By the modern era, Middlesbrough was an internationally renowned centre both for the smelting of iron and the manufacture of steel and it was the exportation of these commodities that was mainly responsible for the increasing importance of its port facilities during the second half of the 19th century. Another chart produced for the TCC, this by George Clarke in 1905 (Figure 14.11), shows that the study site lay within an area of land annotated ‘land reclamation approved by Board of Trade 1902’, with riverside land further south-west, between Cargo Fleet and Eston Wharf, in the course of reclamation due to an Act of 1892. To the south, Grangetown Station had been added to, what was by then, the Darlington to Saltburn Branch of the North Eastern Railway (NER); a signal box dating to 1954 survives to the north-east of the station on the modern version of the line (Figure 14.1, **HER 4782**). The 3rd edition (25” to 1 mile scale) Ordnance Survey map from 1915 (Figure 14.12) shows, in detail, the results of reclamation due to the aforementioned 1892 Act, with the study site skirted to the south-west by an expanse of reclaimed, but as yet largely unoccupied land. The study site itself is shown occupying an area of estuarine sand and mud, therefore still subject to inundation, with a newly established High Water mark skirting the reclaimed land. The positions of the aforementioned beacons along the river wall in the vicinity of the study site are clearly shown on the

25" to 1 mile scale map, as are the Ninth Buoy Front and Back Lights, both 'Fixed Red' (Figure 14.1, **HER 6047** and **6063**, respectively), which are shown connected by a foot bridge. The wider area is shown on the 3rd edition (6 inches to 1 mile scale) map from *c.* 1919 (Figure 14.13), this demonstrating the intensity of industrialization along the railway corridor east of Middlesbrough.

A TCC plan from 1921 (Figure 14.14) shows details of land ownership in the area occupied by the study site, although lying beyond the 'High Water Reclamation Embankment' this appears to be land not yet fully reclaimed. A series of rectangular riverfront plots are delineated in this area, with the easternmost portion of the study site lying within a strip of land owned by the Tees Furnace Co. Limited, while the remainder lying within plot under the ownership of Bolckow and Vaughan Co. Limited. The expanse of reclaimed land to the south and west of the study site is annotated as the 'Eston Urban District' on this plan.

Immediately prior to World War II, the study site still did not occupy fully reclaimed land; a TCC plan drawn by P.A.R. Leith in 1938 (Figure 14.15) shows only its southernmost portion upon reclaimed land, with a riverfront development, named as Teesport for the first time, immediately to the south-west. The facility, and probably the westernmost part of the study site, was evidently owned by Swan Hunter Wigham Richardson and Co. Limited, the company created in 1903 by amalgamation of two Tyneside shipbuilding firms, Swan Hunter with Wigham Richardson, specifically to bid for the prestigious contract to build the RMS Mauretania on behalf of Cunard. The easternmost portion of the study site occupies a strip of land for sale. To the south, land adjacent to the railway line (by then the London and North Eastern Railway), is shown as occupied by extensive spoil tips derived from the Cleveland Iron and Steel Works at Grangetown, by then operated by Dorman Long and Co. Limited, which had taken over the Teesside concerns of Bell Brothers and Bolckow and Vaughan in the 1920s. Two survivng Bessemer blast furnaces from the Cleveland Iron and Steel Works (Figure 14.1, **HER 1831**) lie on the edge of the wider study area, *c.* 2 km to the south of the study site.

The 4th edition (6 inches to 1 mile scale) Ordnance Survey map of North Yorkshire from *c.* 1938 (Figure 14.16) confirms the extent of land reclamation at Teesport at the time of World War II. The 4th edition map for County Durham, also dated *c.* 1938 (Figure 14.17), shows all but the north-easternmost portion of the study site on reclaimed land, with the small Teesport development – which includes two large circular features, presumably chimneys or tanks - encroaching onto its north-western margin. Close to the limit of the south-eastern extension to the study site is a cluster of small buildings of uncertain purpose.

Teesside's industrial capability made it an inevitable target for Luftwaffe bombing during World War II. Towards the north-eastern limit of the wider study area, the HER lists a former World War II 'Q' bombing decoy site (Figure 14.1, **HER 4365**). Sited *c.* 2 km north-east of the Cleveland Iron Works, this was a combined 'QL/QF' site, using both lights ('L') and fires ('F') designed to replicate the furnace glow and railway marshalling yards of the nearby works, as well as being able to provide fires to deceive enemy pilots into thinking that this part of the riverside had already been bombed.

Amongst the collection of aerial photographs (APs) held by Tees Archaeology, two from the immediate post-World War II era demonstrate the extent of land reclamation at Teesport at the time (Figure 14.18). The earliest of these, from November 1946, is of particular note as it shows the extent of reclaimed land at Teesport in very similar form to that shown on the aforementioned 4th edition Ordnance Survey map of North Yorkshire from *c.* 1938, and a similar, although less extensive (south-

eastwards), layout of dockside buildings at Teesport, immediately to the south-west of the study site. The aformentioned cluster of small buildings shown close to the limit of the south-eastern extension of the study site on the 4th edition Ordnance Survey map of County Durham is shown in much developed form on the AP, perhaps suggesting, given the date, that these buildings were of military origin. These buildings also appear on the second AP, from 1948, although detail is harder to discern due to the increased altitude from which the photograph was taken.

The Ordnance Survey map (6 inches to 1 mile scale) of 1955 (Figure 14.19) shows relatively little change at the study site from the 4th edition Ordnance Survey map of County Durham, with only the north-eastenmost portion of the study site still unreclaimed and annotated as 'Mud & Sand'. The adjacent Teesport facility shows some minor amendments and the cluster of small buildings adjacent to the south-eastern extension of the study site remains in place. To the south, this map shows further expansion of Dorman Long's South Bank Iron Works and Cleveland Iron and Steel Works, alongside the railway through Grangetown.

Two plans from the 1960s give precise details of land ownership and usage at and in the vicinity of the study site following construction of Tees Dock; authorized by an Act of Parliament in 1946, its first phase opened for trade in 1962. What is immediately apparent from these plans is that, with the cessation of coal exportation from Teesside by the mid 1960s, the oil and petrochemical industry had attained far greater prominence. The first of these plans, from 1966 (Figure 14.20), was the final plan produced for the TCC, before it handed over its powers to the new Tees and Hartlepool Port Authority in November of that year. It shows the study site adjacent to 'No. 1 Quay' of 'TCC Tees Dock', with the central portion of the site owned by Shell Mex & BP Limited and the original Teesport facility to the south-west owned by ICI. 'Oil Berths' are shown on the riverfront at the study site and a small 'Harbour Office' is shown within its north-eastern corner. Directly opposite Tees Dock, a turning circle for oil tankers is proposed within the river and, on the eastern side of the dock, a large area is earmarked for a Shell oil refinery. The second plan, from 1968 (Figure 14.21) adds additional detail, such as amending ownership of the central portion of the study site to that of Shell (UK) Limited, annotating the north-easternmost area with 'Container', naming its oil berths as 'Queen Elizabeth II Oil Jetty' and 'West Byng Oil Jetty' and annotating Tees Dock 'with 5 Berths 32 feet'.

The Ordnance Survey map of 1973 (Figure 14.22) appears to use detail from a far earlier survey and is thus out of date. It is of use, however, in that it shows detail of the cluster of buildings situated adjacent to the south-western limit of the study site during the 1940s, these postulated above as being of possible military use. Ordnance Survey maps from 1980, 1990 and 1995 (Figures 14.23, 14.24 and 14.25, respectively) show a similar layout at the study site. The large warehousing facility which occupies the north-eastern portion of the site today is in place, and the south-western portion is occupied by an extensive tank farm, of which only the south-western corner now survives, with the north-western portion of the site now cleared and used as dockyards.

14.5 Summary of archaeological potential

The assessment described in this Chapter has identified no known archaeological sites or find spots upon the study site, which occupies land only fully reclaimed from the Tees Estuary since World War II. In the wider study area, on the heavily industrialized south bank of the Tees east of Middlesbrough, there is evidence of activity of post-medieval/industrial and modern date.

The potential and importance of the archaeological resource, broken down into archaeological eras, is summarized below, with a tabulated summary included in Table 14.4, further below.

14.5.1 Palaeo-environmental

The potential for palaeo-environmental remains at the study site is considered **low**. Any palaeo-environmental remains at the study site would be of **local** importance.

Marine Alluvium of post-glacial origin has been recorded by geotechnical site investigations in recent years underlying the area of the study site. Such material, up to more than 5 m in thickness, is typically silty clay with some organic content, including occasional fragments of wood. However, 20th century land reclamation in the vicinity of the study site is known to have required the deposition of a considerable thickness of 'made ground', with the result that marine Alluvium has been encountered at depths varying between 6 m and 20 m below existing ground level.

14.5.2 Prehistoric

The potential for prehistoric remains at the study site is considered **low**. Any prehistoric remains at the study site would be of **regional** importance.

Due to relatively reduced seal levels, the Neolithic and Early Bronze Age may have offered a local population the best chance to use the resources of the study site, lying on a vast expanse of intertidal estuarine mud flats to the south of the river channels. Subsequent silting could have buried (and possibly preserved) any palaeo-land surfaces containing evidence of prehistoric activity. Further afield, prehistoric – particularly Late Bronze Age and Early Iron Age - activity is known on the Eston Hills, although by the Iron Age it is thought that elements of the local population were forced, as a result of soil erosion caused by intensive upland cultivation, to settle and work the margins of the Tees Estuary.

14.5.3 Roman

The potential for Roman period remains at the study site is considered **low**. Any Roman remains at the study site would be of **local** or **regional** importance.

Although the river itself is likely to been used for trade during this period, the very limited amount of evidence of Romano-British activity on the south side of the Tees between Middlesbrough and Teesmouth accounts for the suggested low potential at the study site, which again would only have been accessible at low tide through the Roman period.

14.5.4 Saxon and medieval

The potential for Anglo-Saxon and medieval remains at the study site is considered **low** and any such remains at the study site would be of **local** or **regional** importance.

In the absence of any recorded attempts to reclaim land from the Tees Estuary by the inhabitants of a string of manors occupying land south of the Tees during the medieval period, it is likely that the study site remained as estuarine mud flats, always inundated at high tide, throughout the Middle Ages. While the estuarine margins are known to have been used for pasture as well as for specific industrial

purposes, particularly salt working, the adjacent mud flats skirting the river channels may have seen little or no usage.

14.5.5 Post-medieval/industrial

The potential for post-medieval period and industrial era archaeological remains at the study site is considered generally **low**, at best **moderate**. Any post-medieval and industrial remains at the study site would be of **local** importance.

Attempts to reclaim marginal land on the south side of the Tees Estuary are recorded from as early as the 18th century. The study site, however, lying upon mud flats adjacent to the meandering unregulated river channels that remained at low tide in the post-medieval estuary, is unlikely to have seen significant human activity prior to the industrial era. With industrialization of the south bank of the Tees from the mid 19th century, the potential for evidence of activity at the study site certainly increases, although cartographic evidence shows that the site itself was not fully reclaimed from the estuary until the modern era. Nevertheless, charts compiled in the late 19th century indicate that river channel training walls were in place adjacent to the study site, which lay within a critical area with regard to the siting of navigational aids as the river was canalized, in response to the rapid increase in traffic due to industrialization.

14.5.6 Modern

The potential for sub-surface archaeological remains of modern date at the study site is considered **high**, although the importance of all such remains would be considered **negligible** given that these are likely to comprise, probably exclusively, deep land reclamation deposits. All standing structures at the site, including the extensive Steel Export Terminal warehouse, are of post-date World War II date and of **negligible** archaeological importance.

Cartographic evidence indicates that only the southernmost portion of the study site was fully reclaimed prior to World War II, with the remainder being reclaimed in the period between approval of the 1946 Act of Parliament for the construction of Tees Dock and the opening of the first phase of that facility in 1962. Geotechnical site investigations in the vicinity of the study site indicate that the earliest land reclamation deposits dumped on former areas of estuarine mud flats comprised ‘hydraulic fill’ material, that is silts obtained through dredging of the river, these usually being overlain by iron slag derived from the spoil heaps of former local manufactories. These deposits have been recorded with thicknesses varying between *c.* 1.5 m and *c.* 15.0 m (redeposited river silts) and between *c.* 0.80 m and *c.* 3.0 m (overlying iron slag).

14.5.7 Past impacts on the proposed development site

Potential impacts upon palaeo-environmental and archaeological remains due to previous land-use must be considered, since previous impacts can affect the survival of sub-surface deposits to a widely varying degree.

Prior to full reclamation in the mid 20th century, the study site would have been subject to constant episodic riverine inundation, always lying below the high water mark of the Tees. Deposition of silts could potentially have buried and preserved former land surfaces and any associated archaeological

information. On the other hand, however, the potential erosional effects of episodic inundation must also be considered and such action may have had a significant impact on any palaeo-environmental and archaeological remains at the site, if any were ever present.

During and subsequent to modern land reclamation, the deposition - as an integral part of the process - of significant quantities of, firstly, 'hydraulic' silt fill and, then, iron working residues, could have impacted upon any underlying palaeo-environmental and archaeological remains, in the event that any had been preserved at the site beneath accumulated silts.

14.6 Potential impacts of the proposed development

14.6.1 Construction impacts

In a site with a high probability of finding archaeological remains the precise knowledge of foundation design is the crucial element in facilitating a detailed assessment of the direct and indirect impacts of a major construction scheme on the palaeo-environmental and archaeological resource. For example, use of piled foundations can result in de-watering, which can significantly affect palaeo-environmental deposits, such as peat and alluvium, Should these types of deposit become de-watered *in situ*, they can become desiccated and thereby lose their palaeo-environmental value.

Knowledge of initial groundworks in similar major development schemes, particularly with regard to the creation of general 'formation levels' and the setting out and consolidation of access roads for plant and machinery, indicates that such works can impact to a greater or lesser degree upon buried palaeo-environmental and archaeological remains, depending upon the nature and extent of both the works and the palaeo-environmental and cultural heritage resource. In addition, the cutting of service trenches and connections can cause severe localized impacts upon buried palaeo-environmental and archaeological remains.

However, at the Tees REP site, with the degree of construction impact on the potential palaeo-environmental resource and each element (in chronological terms) of the archaeological resource predicted (as set out in the Table 14.4), the magnitude of change in each case has been assessed, as follows:

- Construction impacts on any palaeo-environmental remains – a locally important resource, in the unlikely event they be present – would be slight adverse without mitigation.
- Construction impacts on any prehistoric or Romano-British remains – a locally or regionally important resource, in the unlikely event they be present - would be slight adverse without mitigation.
- Construction impacts on any Anglo-Saxon or medieval remains – a locally or regionally important resource, in the unlikely event they be present - would be slight adverse without mitigation.
- Construction impacts on any post-medieval/industrial remains - a locally important resource, in the unlikely event they be present - would be slight adverse without mitigation.

- Construction impacts on modern remains – certainly present but an archaeological resource of negligible importance - would be neutral without mitigation.

14.6.2 Operational impacts

No adverse direct or indirect impacts to the archaeological resource caused by the operational phase of the Project are envisaged.

Any palaeo-environmental deposits preserved within underlying alluvial strata could be affected by de-watering associated with the use of piled foundations in the Project and in the event of any such deposit becoming de-watered it could become desiccated and lose its palaeo-environmental value. However, the palaeo-environmental potential for the study site is considered low.

14.7 Mitigation and residual effects

14.7.1 Construction phase

The assessment has concluded that, without mitigation, the potential impact of the proposed development on palaeo-environmental and archaeological remains of all periods, should there be any, will be slight adverse. For modern era remains, the impact would be negligible.

Given a lack of previous archaeological intervention at, or in the vicinity of, the study site, the nature and survival of the palaeo-environmental and archaeological resource at the site cannot be fully understood at this stage. However, the history of land use for the site is relatively well understood due to the detailed cartographic and documentary evidence for this part of Teesside, particularly since mid 19th century industrialization. In addition, previous geotechnical investigations on land reclaimed from the Tees estuary in the last century have established that 'made ground' deposited during reclamation of land adjacent to the existing river channel is typically of several metres thickness, overlying alluvial silts, these also typically of significant thickness.

Therefore, archaeological trial trenching has not been recommended at the study site because of the practical difficulties inherent in small-scale trenching where considerable 'made ground' overburden of negligible archaeological significance can be expected. Accordingly, the results of geotechnical investigations conducted on the study site will be of significance in determining the requirement for an archaeological evaluation. Such results would, firstly, elucidate the potential for palaeo-environmental and archaeological remains at the site and, secondly, provide important information regarding the practicalities of undertaking an archaeological evaluation.

Should archaeological evaluation be required at any stage at the site, the work will target areas of construction impact, to be determined when details of the proposed development are finalized. The nature and extent of any mitigation strategy will be agreed with the development control archaeologist at Tees Archaeology, once construction details of the proposed development have been finalized and the full extent of all impacts have been ascertained.

14.7.2 Operational phase mitigation

A requirement for archaeological mitigation during the operational phase of the Project is not anticipated.

14.7.3 Assessment of residual effects

TABLE 14.4
SUMMARY OF THE IMPORTANCE AND POTENTIAL OF AND IMPACTS UPON THE PALAEO-ENVIRONMENTAL AND ARCHAEOLOGICAL RESOURCE

Baseline Resource	Importance and potential	Predicted development impact	Magnitude of impact (before mitigation)	Proposed mitigation	Residual impact (after mitigation)
Palaeo-environmental deposits	Local/Low	Medium	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Early Prehistoric	Regional/Low	Low-Medium	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Later Prehistoric	Regional/Low	Low-Medium	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Roman	Regional/Low	Low-Medium	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Saxon and Medieval	Local-Regional/Low	Low-Medium	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Post-Medieval/Industrial	Local/Low	Medium-High	Slight Adverse	Examine geotechnical SI results in the first instance	Neutral
Modern	Negligible/High	High	Negligible	None	Neutral

14.8 Conclusions

This Section has established that no statutorily protected archaeological or heritage site will be directly affected by the Project. There are no listed buildings within the wider study area, so the development will have no impact on any such buildings or their settings.

In addition, the assessment has considered both the potential for survival of palaeo-environmental and archaeological remains and the possible impact of the Project upon any such remains. The potential for palaeo-environmental remains and remains of all archaeological eras is considered low with the exception of the modern era, for which the potential is high, although modern remains are

considered to be of negligible importance. Prior to mitigation the Project could have a slight adverse impact on any palaeo-environmental and archaeological remains, should any be present.

It is **not** recommended that archaeological evaluation by trial trenching be carried out within areas of proposed development impact. However, MGT Teesside will make available the results of geotechnical site investigations to an archaeological consultant or the archaeological development control section at Tees Archaeology and help devise a mitigation strategy. Once the strategy has been implemented, the impact of the Project will be reduced to neutral.

15. SUMMARY OF MITIGATION AND MONITORING

The mitigation and monitoring programmes proposed for the Tees Renewable Energy Plant (REP) are summarized below.

15.1 Air quality

15.1.1 Construction

Good site management practices during the construction works will help to prevent the generation of airborne dust. MGT will require its construction contractors to take sufficient precautionary measures to limit dust generation.

To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the site or living nearby a dust monitoring programme will be carried out throughout the construction period. It is proposed that environmental monitoring of dust be carried out at areas of excavation, the stockpiles, various additional locations across the site and at locations on the site boundary. A trained and competent person will carry out monitoring on a weekly basis. If dry windy weather prevails then the rate of monitoring will be increased. An aerosol monitoring system will be used. The results will be checked against Table 15.1.

TABLE 15.1
MAXIMUM ALLOWABLE EXPOSURE LEVELS

Dust	Monitoring location	Level	Action
Aerosol monitoring system (directional, with instantaneous read-out)	Excavation areas Stockpiles	>1 and <5 mg/m^3	Review PPE* level if >1 mg/m^3
Environmental Dust Sampler (gravimetric over fixed time period)		>5 mg/m^3 continuously	Stop work in breathing zone Identify cause and carry out remedial work Review PPE level, go to level 2 respiratory protection Monitor every 30 minutes
	Site perimeter	0.2 mg/m^3	Stop work Identify cause and carry out remedial work
Visual and odour checks	Site wide	Excessive dust or odour	Further monitoring or control measures as appropriate. All such instances to be logged

*PPE - Personal protection equipment.

If the above values are exceeded then the rate of monitoring will be increased to four times a day or to a level consistent with the results that have been logged and additional remedial action as described below will be taken.

If a potential for dust emissions exists, for example on dry windy days, then the following procedure will be followed:

- materials will be tested for moisture content;
- if material is dry then water will be sprayed on to the working area to suppress dust;
- excavation faces not being worked will, if required, be either sheeted or treated with a chemical dust suppressant;
- in addition all operatives working in areas of potential dust emission will be provided with paper type face masks.

Materials deposited on stockpiles on site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a dust suppressant.

If finely ground materials are delivered, these should be in bag form or stockpiled in specified locations where the material can be suitably covered.

All vehicles carrying bulk materials into or out of the site will be covered to prevent dust emission. Minimum drop heights will be used during material transfer.

Dust emission from moving construction plant and site transport will be mitigated by the use of water bowsers, which will dampen all movement areas being utilized by traffic.

A wheel washing facility will be provided adjacent to the site exit and will be used by all heavy commercial vehicles leaving the site, preventing the transmission of soil from the site to the public highway.

Road sweeping vehicles will be employed when required during the construction period to remove dust and dirt from all the public roads.

The above measures may only be necessary should the activities leading to the greatest dust generation occur during a dry period.

If care is taken dust emissions will not impact on local air quality.

15.1.2 Operation

The following mitigating measures have been included in the design of the proposed plant:

- the use of SNCR, which ensures NO_x levels to be in accordance with LCPD requirements;
- the use of a fuel inherently low in sulphur and ash;

- Bag filters to ensure that particulate matter emissions levels are kept below 20 mg/Nm^3.
- a stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.
- The use of completely enclosed storage buildings for the wood store, thereby avoiding any wood chip dust nuisance.

These measures, in combination, result in limited increases in background concentrations of oxides of nitrogen, negligible emissions of particulates and sulphur dioxide, such that no further measures are deemed necessary.

MGT will require a manufacturer's guarantee in place to guarantee the performance of the NO_x abatement system. If NO_x values are outwith the guarantee value the operation and calibration of the instrument will be checked and, if proved to be accurate, the plant will be examined and the fault corrected.

Emissions will be controlled during operation in accordance with the manufacturer's recommendations and the limits and conditions specified in the EPA permit for the process, taking account of the technical guidance available for this type of plant.

The stack will be fitted with continuous monitors for NO_x, CO, particulates and SO_2. The measured value will be recorded and displayed in the control room. Routine calibration checks will be carried out as recommended by the manufacturer and as agreed with the Environment Agency. Any other ad-hoc calibration checks required by the Environment Agency will be carried out. An oxygen monitor will also be supplied and results from this will be used to correct the NO_x measured value to the format required by the EA.

Sampling points and safe access adjacent to the continuous monitoring points will be installed.

Regular observation of chimney emissions will also be made.

15.2 Water quality

15.2.1 Construction

The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that should be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004: 1086. These will be taken into account.

Mitigation measures during construction may include, as appropriate:

- DFO storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.

- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil/grit interceptor(s) prior to discharge
- Measures to be taken to ensure that no leachate or any surface water that has the potential to be contaminated to be allowed to enter directly or indirectly any water course, underground strata or adjoining land.
- Provisions to be made so that all existing drainage systems continue to operate.
- Water inflows to excavated areas to be minimized by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.
- Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

15.2.2 Operation

The Environment Agency (EA) will set limits on the quality of water that is discharged from the site under the EPR Permit.

The Tees REP will use air cooled condensers rather than a wet cooling tower or direct (river) cooling. This decision means that one of the major uses of water, and sources of effluent, has been avoided.

All aqueous process effluents will be discharged to the plant via the drainage system and will be in accordance with EA limits. No on-site treatment will be necessary. This represents the best practicable environmental option for these effluents and is consistent with the approach suggested in Chapter 2 of the EA's PPC combustion Sector Guidance Note V2.03.

The water treatment plant effluent will be monitored for pH value. If the pH is outwith the limit of 6 to 9, or as permitted by the EA, the discharge will automatically stop until the failure is corrected.

All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and sight glasses will also be located within the bunded area. Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified prior to disposal.

The surface water drainage system will drain areas of the site unlikely to be contaminated with oil and discharge the water to the storm water drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from paved areas or roads.

An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.

Although the storage of the woodchip fuel it is unlikely to constitute a significant pollution risk, there is a possibility for acidic run-off from the wood after heavy rainfall. Care will therefore be taken to ensure that the woodchips are only stored on site for short periods (30 days), which limits their potential to generate acidic decomposition products. Run-off from the wood stockpile will pass through an small effluent treatment plant to ensure it does not enter surface water (the River Tees or Kinkerdale Beck) without appropriate controls..

The ash removed from the boiler house will transported by a suitable closed conveyor to dedicated ash storage silos located adjacent to the boiler house. The removal ash is therefore unlikely to cause a significant pollution risk.

Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be regularly emptied and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

15.3 Noise control measures and monitoring

15.3.1 Construction

In order to keep noise impacts from the construction phase to a minimum, all construction activities would be carried out in accordance with the recommendations of BS 5228. In addition, the following mitigation measures would be implemented through the Construction Environmental Management Plan (CEMP):

- Core site working hours would be agreed with the Local Authority, and are specific to the construction site. These are generally Monday to Friday 0700 - 1900 hours and Saturday 0700 to 1700 hours. It would be necessary to work outside these core hours for certain activities but this would be with the prior agreement of the local authority.

- Specific method statements and risk assessments would be required for night working. In order to minimize the likelihood of noise complaints in such eventualities, the contractor would inform and agree the works in advance with the Environmental Health Officer, informing affected residents of the works to be carried out outside normal hours. Furthermore, the residents would be provided with a point of contact for any queries or complaints.

- All vehicles and mechanical plant used for construction would be fitted with effective exhaust silencers, and regularly maintained.

- Inherently quiet plant would be used where appropriate. All major compressors would be sound-reduced models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.

- All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.

15.3.2 Operation

This assessment has shown that the need for mitigation measures is not being driven by the predicted environmental noise levels due to Biomass Power Plant operations. However, inherently quiet plant items will be sourced wherever practicable as a means of best practise.

While planning noise limits will be agreed with the local authority at the planning consent stage, plant operators will aim to better these limits and reduce noise emissions as far as possible. The following measures would serve to continually monitor and minimize the impact of noise from the proposed power plant:

- In the event of a complaint by a local resident relating to noise levels during the operation of the plant, an investigation shall be carried out by the operator, or a representative thereof, to determine the likely cause of the complaint, and any available remedial measures. Where it is deemed necessary by the Local Authority, a written report detailing these measures and their effectiveness will be provided.

- In the interest of maintaining neighbourly relations and residential amenity, the company will give a reasonable period of notice to residents prior to any non-normal operations that would lead to an increase is noise levels. These will be carried out between 0900 and 1700 hours during the weekdays, wherever possible.

- A programme of noise monitoring, including a noise survey shortly following the commissioning of the new plant, shall be agreed with the Redcar and Cleveland Borough Council and implemented at regular intervals. The aim of these surveys shall be to ensure that plant noise levels as measured at the agreed NSR locations do not exceed the planning noise limits agreed with the local authority. Noise monitoring shall be undertaken in accordance with BS 4142.

15.4 Contaminated land

During construction, all spoil will be stockpiled away from surface water and freshly excavated areas. A minimum distance of stockpiles from surface water should be discussed between the EA and construction contractors. Data from intrusive site investigations suggests that the site is not heavily contaminated, therefore, if there is any runoff from stockpiles this is likely to be clean. However, to

prevent suspended sediments entering surface water, stockpiles will be covered with tarpaulin in wet weather to minimize runoff and infiltration from rainfall.

In order to limit disturbance and mixing between soils, groundwater and surface water during construction, the construction area will be delineated and no vehicle use will be undertaken outside the working boundary, other than on hardstanding or access roads. As the majority of the site is covered by road planning with minimal exposed soil, there are unlikely to be negative impacts arising from vehicle movements. In order to further limit disturbance, any additional site access roads required will be constructed prior to any on site excavations.

As there is a significant depth of made ground across the site, excavations for soil to be re-used on site are not proposed. In addition, any imported fill would be of sufficient quality so as not to require crushing with crushing plant.

Current access roads will be used for the site. These roads have been constructed with an appropriate camber and drainage so as to manage heavy rainfall. If any new access roads are required, they will be constructed to a similar standard, so as to cope with additional runoff caused by the site.

Precautions will be undertaken to ensure the complete protection of the watercourses in the vicinity of the site (River Tees and Kinkerdale Beck). In particular, no substance or drainage will be discharged to surface water unless agreed with the EA. In addition, pollution prevention measures will be vigilant on site to prevent any contamination of groundwaters.

A temporary wheel washing facility will be installed to prevent transfer of soil onto nearby public roads. Dust suppression measures will be in place on site to minimize dust levels on the site and in the surrounding environment (potential of inhalation of contaminants).

Excavation and foundation construction would be conducted in a manner that will minimize the size and duration of the excavated area.

All manual workers will wear appropriate PPE during the construction phase and strict hygiene measures should be adopted. Unsupervised man entry into excavations will be avoided.

Appropriate pollution prevention controls should be adopted on site at all times.

The contractor will provide a silt trap and/or oil interceptor at a location agreed with the EA to allow solids or immiscible liquids to settle/separate prior to discharge. The contractor will inspect, empty and maintain silt traps/interceptors as and when necessary. A registered waste carrier will remove from site all sludges or residues collected during cleaning operations off site to a suitably licensed waste disposal facility.

Any pumping of water from excavations will be undertaken at such a rate using an appropriately sized pump in order to avoid unnecessary disturbance or erosion. The location of dewatering pipework will be carefully positioned to minimize the risk of damage. The contractor will regularly inspect all dewatering pumps, pipe work and connections.

The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that would be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004:1986. These will be taken into account as necessary during the construction works.

Storage of fuel would be limited and secure. Temporary diesel storage tanks will be double skinned or contained with an impermeable bund, capable of holding 110 per cent of the tank's contents. Oil will be stored in accordance with the Oil Storage Regulations (2001).

Construction machinery will be checked regularly to prevent oil leaks or other emissions from faulty operation. Any maintenance required would take place over hardstanding or other impermeable ground cover. Refuelling will be limited to a designated area, on an impermeable surface, at a sufficient distance away from any drains or watercourses. Spill kits, absorbent geotextiles and absorbent sands will be available on site at all times, in accordance with the oil storage regulations (2001) and PPG 10. Any spills will be cleaned up as soon as possible, according to the spill response plan in the Working Practice Procedure, with any contaminated sands bagged up and disposed of correctly.

Parking of staff vehicles and equipment will only be permitted in designated areas.

Throughout the works, the Waste Management Duty of Care and Special Waste Regulations will be strictly adhered to, including the collation of all required paperwork and checking of transport and disposal contractors.

Spoil generated on site will be stockpiled, tested for waste acceptance criteria and geotechnical composition if necessary and removed off site by a waste contractor by appropriate means or re-used on site to fill excavations. Vehicles carrying wastes would be suitably sheeted/netted or appropriately covered to prevent the escape of waste materials en route. All works will be undertaken with reference to the Waste Management Duty of Care, imposed by Section 34 of the Environmental Protection Act (1990) and the Hazardous Waste Regulations (2005).

15.5 Visual impact

15.5.1 Construction

A Construction Management Plan would be prepared in support of the proposed site development. The Construction Management Plan will address the following:

- Temporary storage of topsoil and any other material considered of value for retention;
- Wheel washing facilities and soil dampening will ensure that debris and soils do not escape to the surrounding environment;
- Design and layout of site construction areas including the location and type of temporary security fencing and lighting.

15.5.2 Operation

The key mitigation measure has been the location of the plant within an industrial setting. In doing so the need for extensive works on water pipelines and transmission lines has been minimized. Other mitigations measures proposed include the below.

The architectural design of the plant will be sensitive to the suggestions of local planning officers.

The architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints.

The external structures of the buildings will be designed such that there will be no deterioration in the power station's appearance over the 25 years lifetime of the plant.

A limited combination of materials will be used in the construction of the external structures to give a cohesive appearance to the plant. Colour coated profiled aluminium sheeting will be used on upper levels and facing brickwork or dense concrete masonry will be used, where appropriate, at lower levels including low level buildings. A recessive colour scheme will be used in order to break up the impact of the built structures as shown on the photomontages. The final colour scheme will be agreed with Redcar and Cleveland Council.

The renewable energy development will include the following lighting systems: site lighting and emergency lighting, road lighting and area floodlighting. Lighting systems and design will be similar to those used on the various surrounding sites. Lighting systems will comply with current best practice and industry standards in order to minimize light spread and glare off site.

Ways of introducing planting, perhaps as part of an ecological mitigation scheme will be investigated.

15.6 Traffic and infrastructure

15.6.1 Construction

A Traffic Management Plan will be developed, prior to construction, however it is anticipated that all deliveries will be brought to site via the A174, being the preferred strategic route cited by Redcar and Cleveland Borough Council, and Tees Dock Road. Materials will be delivered to site at off peak hours.

Staff traffic will have no prescribed route, and so, will be dispersed over the entire local road network. All vehicle movements will be actively managed, in full consultation with Redcar and Cleveland Borough Council to ensure that any possible inconvenience to other traffic is minimized or eliminated.

To minimize any possible cumulative impact, travel to work options will be actively promoted to the contractors workforce to reduce any conflicts with the other developments in the area that may be proceeding in the same timescale. In addition, MGT will look to integrate the Tees REP and Northern Gateway Transport Management Plans. During the preparation of the Tees REP Transport Management Plan MGT will look to hold discussions with Redcar and Cleveland Borough Council, the Highways Agency, and Northern Gateway representatives to discuss this possibility. One such

mitigation measure that MGT would like to introduce in a joint Transport Management Plan is the employment of shuttle buses to service both sites during their construction

Redcar and Cleveland Borough Council have published a freight transport map that outlines the preferred routes for such traffic and additional information regarding the transport of abnormal loads in the region. While it is anticipated that all movements will follow these guidelines, the routes and timings of the transportation of abnormal loads will be discussed fully with the relevant authorities in order to minimize disruption.

Construction contractors will still be required to perform surveys to ensure that any abnormal load can be delivered to site with the least inconvenience to other road users and, if necessary, be responsible for the cost of any route strengthening requirements. The delivery of the abnormal loads to site will be coordinated with guidance from Redcar and Cleveland Borough Council. A police escort may also be used if deemed necessary.

15.6.2 Operation

No perceivable impact is expected during the operation of the proposed plant however a travel plan regarding mode share forecasts and targets will be submitted to Redcar and Cleveland Borough Council for formal acceptance.

Measures will be introduced to encourage the use of public transport wherever possible including shuttle buses operating along Tees Dock Road and around the Teesport estate. Cycling to work will also be promoted wherever possible.

Detailed survey work will be undertaken on an annual basis to monitor the effectiveness of the travel plan. The results and details of proposed corrective actions, where necessary, will be made available to the planning authority.

The ash produced from the process will be removed from site during off peak hours to minimize any impact on the local network. If a local supply of biomass becomes available it is thought that the HGV trucks used to deliver the biomass could also be used to transport the ash produced by the plant, thereby reducing incremental traffic impact by up to 33 per cent.

Vehicle movements involving the supply of biomass would be strictly kept to off peak hours and agreed with Redcar and Cleveland Borough Council. Night time deliveries will also be considered if thought to be beneficial by the local authority.

15.7 Socio-economics

No mitigating measures or monitoring programmes are considered to be necessary due to the positive socio-economic impact of the project.

15.8 Ecology

Within the context of Ecological Impact Assessment, mitigation is one of a hierarchy of measures that are undertaken to prevent or reduce adverse impacts:

- **Avoidance/prevention**: measures taken to avoid or prevent adverse impacts, eg scheme layout; timing of site works.

- **Reduction/mitigation**: measures taken to reduce adverse impacts, eg retaining walls; pollution interceptors.

- **Compensation/offsetting**: measures taken to offset significant residual adverse impacts, ie those that cannot be entirely avoided or mitigated to the point that they become insignificant: for example, habitat creation or enhancement.

Specific mitigation measures are proposed for all significant ecological impacts on the habitats and species identified in the preceding sections. Generic mitigation measures are also proposed that include best practice methods and general principles that can be applied to the development as a whole, and are relevant to all habitats and species. Prevention or avoidance of these adverse impacts is the primary aim of ecological mitigation. If this is not possible measures would be proposed to reduce the impact and if this is also not possible then measures of offset the impact would be included in the mitigation strategy.

15.8.1 Generic mitigation to avoid impacts

The implementation of a Construction Environmental Management Plan (CEMP) by the appointed Contractor; and the development of a Works Method Statement to illustrate how impacts on ecology will be managed will be created. Good construction site management will be implemented to avoid/minimize generation of excessive litter, dust, noise and vibration. This will be controlled and monitored through the CEMP. Measures will be implemented to avoid/minimize potential for problems such as fuel and other chemical spills. There will be no storage of potentially contaminating materials in areas of hydrological sensitivity, eg in the vicinity of the Tees or the culverted drainage stream. A Pollution Incident Response Plan will be included as part of the CEMP to ensure that impacts from any potential accidental spills can be reduced to a minimum. In addition, the following measures should be included in the CEMP:

- ensure that work compounds and access tracks etc are not located in, or adjacent to, areas that maintain habitat value;

- establish site fencing to prevent access to areas outside working areas, particularly in areas adjacent to features of interest/value;

- implement procedures to cover site safety issues, including storage of potentially dangerous materials;

- provide briefings and instruction to contractors regarding the biodiversity issues present on the site; and

- follow pollution prevention guidelines provided by the Environment Agency (eg PPG01, PPG02, PPG03, PPG05 and PPG06) to prevent pollution of water courses from silt or chemicals.

15.8.2 Generic mitigation to reduce impacts

- Restrict workforce to working areas through the erection of fencing, to prevent additional damage;
- best practice methods would be followed throughout; and
- establish protocols and contingency plans for dealing with incidents should they arise.

15.8.3 Generic mitigation to offset impacts

Ensure all new landscape plantings in non-urban surroundings are comprised of native species, of local provenance, planned to complement the semi-natural habitats of the local area.

15.8.4 Mitigation of impacts to VERs

The potential impacts identified as a result of the proposed development are of local-negative significance.

Where potential exists for terrestrial breeding birds (scrub vegetation and buildings), removal or demolition will be undertaken outside the bird breeding season (March to late September inclusive for the majority of species) or alternatively, an ecologist will supervise the works.

Construction and operational lighting will, wherever possible, utilize low pressure sodium lamps or high pressure sodium instead of mercury or metal halide lamps. Lighting will be directed to where it is needed and light spillage avoided. This will be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only.

In addition, off-site compensation in the local area will be implemented and this is considered to provide sufficient mitigation for the effects of the scheme and further, add net ecological gain. MGT will partner will other local industry and INCA in the area to re-establish intertidal habitat for a variety of species, including invertebrates and birds. MGT is currently investigating various opportunities that have recently been identified in the area for their suitability.

15.9 Cultural heritage

15.9.1 Construction

The assessment has concluded that, without mitigation, the potential impact of the proposed development on palaeo-environmental and archaeological remains of all periods, should there be any, will be slight adverse. For modern era remains, the impact would be negligible.

Given a lack of previous archaeological intervention at, or in the vicinity of, the study site, the nature and survival of the palaeo-environmental and archaeological resource at the site cannot be fully understood at this stage. However, the history of land use for the site is relatively well understood due to the detailed cartographic and documentary evidence for this part of Teesside, particularly since mid 19th century industrialization. In addition, previous geotechnical investigations on land reclaimed

from the Tees estuary in the last century have established that 'made ground' deposited during reclamation of land adjacent to the existing river channel is typically of several metres thickness, overlying alluvial silts, these also typically of significant thickness.

Therefore, archaeological trial trenching has not been recommended at the study site because of the practical difficulties inherent in small-scale trenching where considerable 'made ground' overburden of negligible archaeological significance can be expected. Accordingly, the results of geotechnical investigations conducted on the study site will be of significance in determining the requirement for an archaeological evaluation. Such results would, firstly, elucidate the potential for palaeo-environmental and archaeological remains at the site and, secondly, provide important information regarding the practicalities of undertaking an archaeological evaluation.

Should archaeological evaluation be required at any stage at the site, the work will target areas of construction impact, to be determined when details of the proposed development are finalized. The nature and extent of any mitigation strategy will be agreed with the development control archaeologist at Tees Archaeology, once construction details of the proposed development have been finalized and the full extent of all impacts have been ascertained.

15.9.2 Operation

A requirement for archaeological mitigation during the operational phase of the Project is not anticipated.