

1.8 DEMAND FOR THE PROPOSED DEVELOPMENT

- 1.8.1 Studies were carried out to provide forecasts of the expected throughput for the proposed London Gateway Container Terminal and Ro-Ro facility. Forecasts of future container traffic through UK ports were prepared and compared with existing port capacity together with known expansion plans.
- 1.8.2 This established the requirement for additional port capacity at London Gateway to satisfy the growth in container throughput at UK ports.
- 1.8.3 An associated study assessed the navigational requirements in terms of channel depth and width for the large container ships which would be expected to call at London Gateway.
- 1.8.4 On the basis of these studies, the Promoter considers that there is a strong case for the development of a port in the manner proposed to meet the existing and growing needs of the UK. Such a port proposal would offer the ability to provide the economic and efficient throughput of containers, general cargo, cars, aggregates, Ro-Ro traffic and bulk fluids to meet this need for the foreseeable future.

1.9 LEGISLATIVE AND POLICY CONTEXT

National and regional policy context

- 1.9.1 London Gateway Port would make a major contribution towards meeting regional policy objectives and guidance for Thames Gateway as set out for example in RPG9 (Regional Planning Policy Guidance for the South East), RPG9a (Thames Gateway Planning Framework) and RPG9b (Strategic Planning Guidance for the River Thames).
- 1.9.2 In this context, it represents a substantial private inward investment initiative in an area which is accorded a national and regional priority for regeneration and the securing of economic development. It also has the significant advantage of avoiding the consumption of greenfield resources and optimising the use of land providing development for employment purposes. Furthermore, it represents a sustainable form of development fully in accord with the planning framework principles established in RPG9a.
- 1.9.3 The proposals are consistent with the objectives of national policy guidance in terms of achieving sustainable development and securing regeneration opportunities (Planning Policy Guidance Notes (PPGs) 1 and 4).
- 1.9.4 The proposals accord with the general locational guidance for major freight/distribution development set out in PPGs 4 and 13, and with the guidance for the location of major development in coastal locations (PPG20).
- 1.9.5 In transportation terms, the proposals are compliant with the guidance in relation to freight related development set out in PPG13, with the Government's Sustainable Distribution Strategy, and with relevant elements of regional transport strategy contained in RPG9.

Local policy context

- 1.9.6 The confinement of the major built elements of the London Gateway proposal to brownfield and allocated development land in the adopted Thurrock Borough Local Plan would ensure that the scheme would not substantially impinge on environmental and natural resources. These are the subject of protection through relevant policies from national level through to the local level.
- 1.9.7 Where environmental and natural resources and amenity considerations would be affected, it has been demonstrated either that there are very special circumstances which justify that aspect of the development (such as in relation to Green Belt policy) or that any harm which would arise could be successfully mitigated (including landscape, visual effects, ecology, cultural heritage, or noise).

1.9.8 In relation to the adopted Borough Local Plan, the land required to accommodate the port is allocated in such a way as to reflect an existing permitted employment use (the oil refinery) or for related future development. The current proposals represent an alternative form of employment in circumstances where there is no prospect of resumption of the former use, and where the emerging UDP and Thames Gateway South Essex strategies acknowledge the regeneration and employment potential of Shell Haven.

1.9.9 With regard to the proposed UDP, the proposed development would accord with the emerging Strategy Framework and be consistent with the recognition of Shell Haven as a flagship employment site.

Policy compliance

1.9.10 The proposals are also compliant with policies relating to:

- a) Thames Gateway development
- b) economic and employment considerations
- c) transportation
- d) environmental issues, natural resources and amenity
- e) development plan issues
- f) sustainability

1.9.11 The following policy documents are also complied with:

- a) Sustainable Distribution: A Strategy. This encourages more freight to be carried by rail and water and aims to improve the integration of the road network with major transport interchanges in order to promote greater use of rail and water transport for freight.
- b) Modern Ports – A UK Policy. This highlights the importance of Gateway Ports to the national economy, of supporting sustainable port projects where there is a clear need and emphasises the importance of providing modern rail facilities in port investment plans.
- c) Thames Gateway South Essex Vision document. This highlights the opportunity presented by Shell Haven for port development.
- d) The Thurrock UDP Issues Report's proposed Strategy Map identifies Shell Haven as a site to provide new port facilities, new freight terminal and as a flagship employment site.

1.10 ASSESSMENT METHOD

1.10.1 The EIA methods adopted in the HEO ES conform to the principles and procedures recommended in the former Department of Environment, Transport and the Region's EIA Guide to Procedures and the former Department of the Environment's Good Practice Guide for the preparation of ESs insofar as they are relevant to the current Regulations. They accord with best practice in ES production generally.

Baseline studies

1.10.2 A comprehensive data gathering exercise was undertaken by the Design and Assessment Team from Autumn 2000 to the present. This drew upon valid, relevant data from earlier studies, but also involved original work directly related to the London Gateway Port proposals. It included:

- a) desk studies, including an examination of written references and text records, statistical data, current and historical mapping and aerial photographs
- b) technical consultations with and requests for specific information from organisations in a position to provide relevant material
- c) initial site surveys, for familiarisation, photographic or preliminary survey purposes
- d) follow-up surveys to re-examine specific areas where features of interest have been identified during any of the preceding stages
- e) use of specific techniques to accurately establish baseline conditions, such as invasive borehole testing to establish sub-surface conditions, or applications of industry-standard models to quantify existing traffic flows or ambient noise conditions

Consultations

1.10.3 A large number of meetings and technical consultations have been carried out – on a commercial-in-confidence basis where necessary – with consultees, statutory bodies or other organisations and individuals with responsibility for or an interest in environmental issues associated with the port site and/or its redevelopment.

1.10.4 In addition, more formal pre-scoping consultations, draft scoping and scoping consultations were held with 59 organisations. This included many face-to-face meetings, including follow-up and feedback meetings.

1.10.5 Scoping describes the process whereby the approach to the EIA and the range of issues to be considered were discussed and refined through meetings and other consultation with a wide range of organisations including the statutory consultees. This process was undertaken in Spring and Summer 2001.

Assessment of effects

- 1.10.6 The HEO ES reports the HEO EIA process which has predicted and assessed the effects of the proposed development likely to be experienced during the period of its construction and operation. Each Key Issues section in Part B of the ES therefore contains an assessment of the potential construction-related effects on that subject area, and for an appropriate geographical area, while for the post-construction, operational period, a start-date was assumed for assessment purposes. This was an hypothetical 'day 1' after completion of the Port in 2018, when the Port would be fully built and functional.

Mitigation

- 1.10.7 Identification and implementation of mitigation measures is one of the most important aspects of the EIA process. In the case of the proposed London Gateway Port, considerable efforts have been made to ensure that predicted adverse effects would be reduced by careful design.
- 1.10.8 If significant adverse effects on the environment are identified, the EIA Regulations require that the ES should specify measures to avoid, reduce or remedy those effects. Such mitigation measures may involve alteration of the design or operation of the development proposals, or may introduce particular safeguards to ameliorate potential effects. During the development of the proposals for London Gateway, once adverse effects were identified, mitigation measures have been introduced into the design proposals themselves.
- 1.10.9 The use of the EIA as an integral part of the design process has also enabled the Promoter to identify measures to create or even enhance potential beneficial environmental effects, to the benefit of local communities.
- 1.10.10 As a result, many of the adverse environmental effects predicted have been significantly reduced or removed altogether by mitigation measures. Opportunities for enhancement have been incorporated into the design of the proposed development wherever appropriate.

Residual effects

- 1.10.13 Summary effects of the proposed development as shown in the ES are based on the residual (that is, following mitigation) effects of the proposed development on the environment, both during and after the construction of the port and in the long term.
- 1.10.14 Tables A and B at the end of this NTS summarise the key residual effects of the proposed port during its construction and operation respectively. These residual effects are those which have been assessed to be of more than Minor significance, after the benefits of the proposed mitigation measures have been taken into account.

2 KEY ISSUES

2.1 INTRODUCTION

2.1.1 The Key Issues part of the ES considers the potential effects of the proposed London Gateway Port on a range of subject areas, or Key Issues. These were identified through the Scoping process and on the basis of the Design and Assessment Team's experience in similar development proposals and EIA.

2.2 MARINE AND COASTAL PROCESSES

Introduction

2.2.1 This section of the HEO ES seeks to identify the nature of river flow, tidal, sedimentation and other processes within the river Thames and Estuary, and the way in which these are predicted to change with the development of the proposed London Gateway Port. The nature of these changes is then used in other sections, notably those dealing with seawater quality, marine ecology and fisheries, as the basis for identifying potential environmental effects, and their significance.

2.2.2 It is not the intention, therefore, to assess whether predicted changes in marine and coastal processes are adverse or beneficial *per se*, but rather to present the information, and therefore allow the appropriate key issue sections to make these assessments as to the effects on the key issue concerned.

2.2.3 The proposed port development has the potential to affect sediment transfer and deposit processes in the Thames Estuary. This is as a result of land reclamation for the new quay; dredging of navigation channels; and shipping movements. Accordingly, the EIA has considered the existing and predicted form of the Estuary-bed local to the development, tidal currents and wave behaviour. It has also examined predicted sediment movements following capital dredging (that is, dredging related to initial construction of the port), and possible future maintenance dredging. Computer modelling, based on a range of survey data and chart information, has been used to predict the type and extent of changes that may result.

Existing situation

2.2.4 The movement of sediment in the Thames Estuary is a highly complex process involving many different influences. For the purposes of the design and assessment work the study area has been split into the Thames Estuary west of the Oaze Deep to Gravesend (the Lower Thames Estuary) and the Outer Thames Estuary, further to the east.

2.2.5 To the west of Oaze Deep, that is, further upstream in the Estuary, sediment movement is dominated by tidal processes. To the east, the situation is much more complex with tidal currents in the Outer Thames area influenced by the filling and emptying of the southern North Sea from the north and through the Straits of Dover, and currents are also strongly affected by numerous sand banks. Wave conditions in the vicinity of Oaze Deep are affected both by waves from the North Sea and local waves generated within in the Thames Estuary.

- 2.2.6 The tidal range is considerably less in the Outer Estuary than experienced further upstream. The mean range on a spring tide is 3.7m at Walton, 4.2m at Margate and 4.7m at Shivering Sands. In contrast, from Oaze Deep, west to Gravesend, the mean spring tide range increases from about 4.7m, to 5.3m at Southend, 5.5m at Canvey and 5.9m at Tilbury.
- 2.2.7 The bed material of the Thames Estuary consists of a complete mixture of sediments ranging from coarse gravels, through sands and shell, to fine muds. In general terms, the upper reaches of the Estuary are characterised by muddy deposits on the intertidal areas (those areas between average high and low tide marks), occurring as mudflats, with more mixed sediments in the sub-tidal (below average low tide mark) zone. In the outer parts of the Estuary, the intertidal areas are more sandy as a consequence of the more exposed environment.
- 2.2.8 The movement of finer sediments in the Estuary is broadly in balance. Higher river flows bringing sediment downstream in late autumn/early winter are balanced by gradual movement upstream of river bed muds in the lower flow summer months. In the Outer Estuary there is a net seaward movement of coarser sediment and sands. As a result there is only a limited requirement for maintenance dredging of navigation channels.
- 2.2.9 The present annual requirement for maintenance dredging is typically between 50,000 cubic m and 150,000 cubic m and is removed using conventional dredging methods. In addition, water injection dredging of between about 120,000 cubic m and 150,000 cubic m is undertaken at the berths between Shell Haven and Canvey Island. A further 30,000 cubic m to 50,000 cubic m is removed by water injection dredging from the entrance to Tilbury Docks. None of the maintenance-dredged material is disposed of to sea.

Morphology

- 2.2.10 For the last few centuries the form of the sea bed and channel in the Thames Estuary has been subject to much change because of the extensive, relatively uncontrolled, dredging and bankside development that has taken place. A survey of the Thames Estuary in 1834/5 was the first major survey that was of an accuracy that allows reasonable comparison with contemporary surveys. This survey clearly defines the bank line and the principal features of the river channel.
- 2.2.11 This survey has been compared with a range of recent surveys undertaken in 1970, and by the Port of London Authority in 1993 and 1998. The main changes that have occurred during the period examined, excluding the intertidal Blyth Sands and Mucking Flats areas, are:
- a) the artificial deepening of the Yantlet Channel which was carried out in two phases (early twentieth century and again in about 1962) accompanied by the shallowing of the old navigation channel that passed close to the southern end of Southend Pier; and
 - b) the area of sediment build-up (accretion) that occurred on the northern foreshore at the seaward end of Gravesend Reach following the construction of the Diver Shoal Groynes in 1995.

2.2.12 There is sediment accretion at Holehaven Creek immediately downstream of the proposed port and at Mucking Flats, immediately upstream, where there was an average annual accretion rate of about 11mm in the 28 years to 1998. However, this applies to the upper intertidal areas, and there is evidence of erosion in the lower intertidal. At Blyth Sands on the south side of the Estuary accretion is resulting in an increase in the intertidal area of about 7ha per year, although the western end of the Sands is being eroded. It may thus be seen that the Estuary is subject to a continuous process of change.

Predicted effects

2.2.13 There would be about 93 ha of sea bed covered by reclamation to form the new quay (that is, about 1ha more than the proposed area for the quay itself), of which 25 ha would be intertidal sea bed and 68 ha sub-tidal sea bed.

2.2.14 In the order of 1,700 ha of seabed would be affected by proposed dredging. Of this, 112 ha would be for the manoeuvring and berthing areas at the port, 1,520 ha would be associated with dredging of the navigation channel, and 63 ha for the anchoring area. The channel dredge would not necessarily affect all of this area directly, as it would be designed to remove existing higher spots in the channel in order to achieve the consistent increased navigation depth required.

2.2.15 There would be a range of changes to mud flats at locations including Mucking Flats and Blyth Sands due to these works. These would result from changed rates of sediment build-up and erosion following changes in river currents and the amount of sediment carried. Changes are also predicted in respect of wave action, sediment carried in the water and the pattern of Estuary currents. Many of these effects would be imperceptible to the human eye, but could result in long term changes to the Estuary channel and its behaviour.

2.2.16 As noted earlier, this section of the HEO ES forms the basis of the assessment of effects in relation to seawater quality, marine and coastal ecology/ornithology, and fisheries. Key marine and coastal processes effects which are considered in the Key Issues sections referred to are summarised in the paragraphs below.

2.2.17 The proposed development is predicted to have a long-term effect on the form of Mucking Flats, with rapid sediment build-up occurring at the seaward end. This would probably develop into saltmarsh, potentially leading to a reduction in the area of intertidal mudflat. Following the dredging for the berthing pockets it is predicted that sediment accretion would occur in the pockets, depleting the amount of muddy sediment that would otherwise have been transported back upstream. The western extent of the proposed dredging for the manoeuvring and berthing area at the frontage of the proposed port also represents a significant change to the orientation of the deepwater channel around the bend at Lower Hope Point.

2.2.18 These factors, coupled, with the present dynamic nature of the western end of Blyth Sands are likely to initiate some large-scale change in the form of the Estuary bed in this area.

- 2.2.19 The proposed works for the Amelioration Lands would not involve significant changes to processes within the Estuary or the form of the Estuary bed. There could be some new channels eroded through the intertidal area in front of the proposed sea defence breaches. These would be created as a result of the outflow of water from the proposed new inundated areas as the tide falls.

2.5 SEAWATER QUALITY

Introduction

2.3.1 The EIA has considered the possible effects on seawater quality in the Estuary as a result of the building and operation of the port. The principal seawater quality issues relate to potential effects from:

- a) increased amounts of sediment released into the water during port reclamation and dredging activities;
- b) from contaminants which could be released from the site through surface water run-off, and from disturbed sediment during dredging; and
- c) contaminants from shipping when the port was operational.

2.3.2 The relationship of seawater quality to activities in the Estuary, notably shell fisheries and bathing waters has been considered.

Existing situation

2.3.3 Existing seawater quality in the Thames Estuary is generally good, and reflects a longstanding trend of improvement which has accompanied a reduction in the scale of industrial activity in the London area, combined with an improvement in environmental controls.

2.3.4 The assessment has included consultations with the Environment Agency and with other relevant agencies including the Port of London Health Authority, and annual survey data collected by the Environment Agency have been referred to in the assessment. Survey work has included 29 core samples taken from the sea bed along the proposed dredge for the main approach channel. These samples have been subject to analysis for levels of contaminants in the sea bed sediments.

2.3.5 Analysis of the survey data collected by the Environment Agency on an annual basis shows that in the majority of cases contaminant levels are below standard guideline levels, and in many cases there is a trend of falling levels of contamination. The levels referred to include Environmental Quality Standards (EQS) derived from the 1976 EC Dangerous Substances Directive, applicable to water quality, and standards prepared in Canada which have become internationally recognised; the Interim sediment quality guidelines (ISQG). Other standards are also referred to in the HEO ES.

2.3.6 There are several designated bathing waters in the outer River Thames Estuary. Three bathing waters situated around Southend have been designated since the late 1980s. These waters are known as Shoebury East, Southend Thorpe Bay and Southend Westcliff Bay. All three beaches have been classified as having at least good bathing water quality since 1997.

2.3.7 Prior to the 2001 bathing season, another two bathing waters around Southend were designated at Shoeburyness and Three Shells, for which no data have been available. New bathing waters at Canvey Island and Leigh-on-Sea have been proposed, and for the past three seasons, both bathing waters have achieved the necessary standard meaning that they would be classified as having Good water quality.

- 2.3.8 Although there are no shellfish waters directly adjacent to the site of the proposed London Gateway Port, there are several designated shellfish waters within the vicinity of the outer River Thames Estuary. These are areas designated under the 1979 EC Shellfish Waters Directive which is implemented through UK legislation. This requires designation of shellfish waters and requirements for water quality to ensure appropriate quality of shellfish for human consumption.
- 2.3.9 The alignment of the proposed approach channel is situated within several designated waters in the outer Thames Estuary. The Southend shellfish water extends across the Thames Estuary mouth between Southend and the Isle of Grain/Medway Estuary. Three other designated waters extend from the eastern boundary of the Southend shellfish water. The Foulness shellfish water extends along the Essex coast, from Shoebury Ness to the mouth of the River Roach, and generally covers Maplin Sands. The Sheppey shellfish water extends along the Isle of Sheppey, on the Kent coast. Beyond Sheppey, further east along the Kent coast lie the shellfish waters of Swalecliffe and Margate. There are also shellfish waters within the Swale Estuary, named Swale East and Swale Central. Finally, in between Foulness and Sheppey/Swalecliffe/Margate waters, the Outer Thames shellfish water extends offshore. The Outer Thames water does not border the coast but covers a large sea area approximately as far north as Bradwell on Sea (just below the mouth of the River Blackwater Estuary) and as far east as Margate, to a north-eastern corner approximately positioned at the Barrow Deep anchorage.

Predicted effects

- 2.3.10 Construction of the quay could involve the use of plant and machinery in and adjacent to the Estuary waters, disturbance of potentially contaminated land on the site of the former refinery, and the use of potentially contaminative materials such as paints and concrete. These potential effects have been considered, and mitigation is proposed in terms of site management arrangements and the phasing of work such that the use of plant and machinery, and pollutive substances over the water would be minimised, and the management of these activities where they were essential would be tightly controlled. There would remain some risk of adverse effects, however, and taking a worst-case it has been concluded that a minor adverse effect could result from these activities.
- 2.3.11 During construction there would be substantial disturbance of sediments as a result of dredging activities and during reclamation for the Port. These activities are the main aspects where significant effects on sea water quality could occur.
- 2.3.12 In order to reduce the potential for adverse effects, dredging techniques would minimise the amount of fine sediment released into the water. This would be achieved by careful management of the dredging operation in order to limit overflowing from the dredge equipment, particularly during the dredging of silty sands. It would also be proposed to place controls on the reclamation operation such that runoff from the deposited dredged material would flow through interceptors which would remove sediment prior to the discharge of water back into the Estuary. Effects from the introduction of sediment into seawater are predicted to be of minor adverse significance.

- 2.3.13 Adverse effects on water quality could arise from sediment disturbance in relation to shell fisheries and bathing waters, as a result of contaminants released from sediment, including viruses and bacteria. It is not certain that these effects would, in the event, arise, but the HEO ES has taken a worst-case position and assessed the proposals on the basis that they would occur. On this basis it has assessed them as minor adverse.
- 2.3.14 The limited amount of maintenance dredging predicted to be required when the port was operational, together with shipping movement would have the potential for similar adverse effects. Dredging activity would be subject to the same range of mitigation, although there would also be greater opportunities for seasonal timing to further minimise the risk of adverse effects on shellfish and bathing water quality. Shipping activity has been considered to be unlikely to give rise to significant adverse effects. The HEO ES has taken a similar worst-case position for maintenance dredging as for the capital dredge referred to above, and has assumed that periodic minor adverse effects on shell fish waters and bathing waters would arise.
- 2.3.15 Adverse water quality effects could arise from accident incidents and poor waste management practices if these were permitted. Shipping could affect seawater quality if wastes were to be discharged into the Estuary and from the use of anti-fouling paints. Pollutants could be washed from the port itself if spillages occurred and were then washed into surface water discharges into the River Thames.
- 2.3.16 Ships using the port would be required to adhere to waste management practices which would avoid adverse effects on seawater quality. The use of anti-fouling paints is tightly regulated. No ship maintenance facilities would be provided at the port and therefore no painting or paint stripping of anti-fouling would take place, which is the main source of this form of contamination. Nonetheless, due to the fact that the material is designed to slowly leach from vessels hulls, and that vessels will be present at the port, a minor adverse effect on water quality is predicted from this source.
- 2.3.17 Surface water drainage facilities on the port would be fitted with interceptors to minimise to an acceptable degree the risk of contaminants such as fuels oils or sediment washing off the site. Standard emergency procedures to deal with the event of a cargo spillage on the port, or a fire which might result in washed-off contaminants, would be put in place, as is required at other ports and estuaryside industrial sites. A potential minor adverse effect from this source is identified, although this would only occur if such an incident was to take place, and therefore the assessment of effect relates to a risk rather than an actually predicted event.

- 2.3.18 The construction of the Amelioration Lands managed retreat sites is not predicted to have a significant effect on water quality in the Estuary other than minor adverse temporary and localised effects from sediment introduced into the water when the sites were first inundated. This would be the result of scour which is the effect of seawater running out of the sites as the tide falls, cutting into the mud at the sea defence breaches at the sites. This effect would reduce quickly as the channels created reached a stable condition. There would also be the risk-based minor adverse effect associated with having construction plant and machinery in close proximity to the Estuary waters, and as for other construction effects referred to above, this assessed as a minor adverse effect.

2.3 GROUND CONDITIONS, CONTAMINATION AND GROUNDWATER

- 2.5.1 The port proposals and transport proposals have been considered in the EIA in respect of their potential effects on ground conditions and groundwater, primarily in relation to the potential for contamination effects at the site. Due to the longstanding industrial uses at the site there is contamination of soils present, primarily as a result of oil spills over many years. This is currently the subject of a site-wide contaminated land remediation strategy being implemented by Shell prior to any redevelopment taking place, to a standard agreed with the appropriate regulators. This work does not form part of the London Gateway proposals and effectively represents the last phase of refinery use as opposed to a precursor to redevelopment.
- 2.5.2 It is possible that there will be a need for further clean-up in certain areas of the site as part of any redevelopment that takes place, depending on construction works and future uses proposed. This might be the case, for example, if particularly deep or complex foundation structures were required for new development, in which case an appropriate remediation strategy would be devised and agreed. There is no requirement for such works as part of the port proposals.
- 2.5.3 The refinery site is overlain by areas of man-made ground up to 2m thick, which includes building rubble and other tipped materials deposited from the late 19th century to recent times. Beneath this layer there are significant depths of natural silts, sands and gravels, peat, and other geological material typical of a river valley location. These materials have limited ability to support major development using simple foundations, and it would be necessary for to use piles (concrete or steel columns driven into the ground) as part of the London Gateway Port foundations.
- 2.5.4 There are three 'layers' of groundwater (groundwater is water present beneath the surface, as opposed to streams and rivers) present at the site. These are waters held within the shallower sands and silts (the 'shallow aquifer'); deeper waters held in sands and gravels (the 'deep aquifer'); and water held within chalk bedrock beneath the site (the 'chalk aquifer'). Historically, the chalk aquifer has been used as a water source because of its quality and quantity, with a number of boreholes situated to the north of the former refinery. There are no licensed wells of this type within the development site.
- 2.5.5 There is a risk of unexploded ordnance remaining within the site following World War II bombing. However, remediation works undertaken to date have revealed very little incidence of such devices, and development at the adjoining refinery site has not encountered any evidence of unexploded ordnance.
- 2.5.6 Adverse effects could occur during the construction of the development and proposed rail improvements, as a result of the various construction processes and works proposed. Minor adverse effects are predicted in relation to piling as a result of the potential for new pollution routes from the surface layers toward deeper groundwater. The construction design proposals minimise risk by proposing a form of pile which can be driven such that potentially contaminated materials would not be carried downward from the surface.

- 2.5.7 Contaminated water currently held within the soil could be released as a result of excavation and other ground works. This effect would be mitigated by the installation of an appropriate drainage system during the construction works which would control potentially contaminated waters and allow appropriate treatment.
- 2.5.8 The placement of dredged material on the port site is not predicted to give rise to significant adverse effects in respect of contamination or release of polluted water from the site. The capping effect of this material would represent a moderate benefit as it would significantly reduce the contamination risk at the site.
- 2.5.9 The proposed Amelioration Lands would be constructed on what is currently agricultural land, albeit land that historically was reclaimed from the sea. Some potential minor adverse effects are identified in respect of groundwater quality at both sites through the potential disturbance of agriculture-related contamination, and possible risk of salt water penetrating groundwaters. These are identified primarily as risks rather than actual predicted effects, but on the worst-case basis are identified as minor adverse effects.
- 2.5.10 When operational, the port would have a comprehensive surface water drainage system allowing the collection and, where necessary, treatment of water collected at the site. This would represent a benefit over the existing situation in terms of pollution control as there are currently a number of outfalls to the Estuary. The increased areas of hardstanding would mean that there was a reduction in water available to soak into the ground and recharge ground water resources, and this has been assessed as a minor adverse effect.
- 2.5.11 The effects of the proposed port are predicted to be beneficial to both the condition of the land, having particular regard to the level of existing contamination, and to the condition of groundwater in the vicinity of the development site. Sources of contamination would be removed, and the ground and water conditions at the site would be made more stable by the development. Drainage facilities would be improved. Overall, the proposed port development works are assessed as a major benefit in securing the redevelopment of part of a large brownfield site.

2.6 CULTURAL HERITAGE

Introduction

- 2.6.1 Cultural Heritage refers to the historical interest of the site, primarily its archaeological interest. The EIA has considered the potential effects of the proposed London Gateway Port development on all aspects of archaeology and built heritage. The study area takes in the former refinery site, the transport corridors of the railway and The Manorway/A13 which could be affected, and the areas of the Thames Estuary which would be affected by reclamation and dredging, as far east as The Sunk in the southern North Sea.
- 2.6.2 The assessment included a desk-based study using documentary, map and air photographic sources. A geophysical survey was undertaken using magnetometer equipment designed to pick up differences in magnetic fields in the ground, which can be used to help identify the presence of below-ground features without the need for excavation. Finally site 'walkovers' were conducted to identify features in the field; these were targeted primarily to the areas potentially affected by the transport corridor works anticipated, and also included the foreshore intertidal areas at the site frontage to the Estuary. Visual surveys were made of the Amelioration Lands sites A and X from public footpaths at these sites.
- 2.6.3 The study considered how historical ground surfaces and other features such as river channels and former coastlines, now below ground, may be positioned, using information from boreholes. This information was collated into a three dimensional sub-surface 'model' of the site in order to help understand the potential for important buried landscapes being present.

Existing situation

- 2.6.4 A key finding of the EIA is that the site is in an area which has high archaeological potential for features of the prehistoric period onwards. This is due to the location of the site in a river valley/estuary setting, and the changes that have occurred in the site's setting in relation to sea levels and river channels over that period. Development is therefore predicted to affect unrecorded archaeological deposits, the nature and importance of which are unknown. In this regard the EIA has had to take a worst-case position, since the precise nature of the archaeological resource present cannot be established. A limitation of the study has been almost total absence of previous archaeological investigations of the area.

Predicted effects

- 2.6.5 The proposed port development would have no direct effect on any Scheduled Monuments, Registered Parks or Gardens, Historic Battlefields, or Conservation Areas. It would affect a number of known archaeological sites, most of which are recorded in the Essex County Council's Sites and Monuments Record and National Archaeological Record databases.

- 2.6.6 The proposed capital dredge would affect 53 identified wrecks along the approach channel during the construction phase of the proposed development. The importance of many of these 'known' sites is not clear, as at this stage they are indicated only by fouls and obstructions, primarily in relation to fishing activity, and there has not been any further investigation. There could be many other wrecks that have not been identified which would also be affected, which currently do not project above the sea bed. The proposed dredging at the frontage of the port, and proposed reclamation works, would also affect a number of wrecks identified on charts as seabed obstructions, and 11 non-scheduled archaeological sites. These sites are areas where Roman finds have been discarded in the past, and the remains of post-medieval and modern maritime infrastructure such as jetties and staithes.
- 2.6.7 The Proposed road and rail corridor improvements would affect a range of non-scheduled archaeological sites. The proposed A13 road improvements would affect 14 known archaeological sites, which include areas of known multi-period activity dating from the prehistoric period onwards; two Roman sites; cropmarks; the site of a medieval moated house; and four sites of post-medieval date.
- 2.6.8 The proposed improvements to The Manorway and the access road into the port would affect 15 known archaeological sites and findspots identified by the assessment. These include areas of prehistoric finds and cropmarks, known Roman and medieval sites, possible remains of earlier sea defences, World War II structures and associated with the former refinery uses.
- 2.6.9 The proposed rail improvements would affect two known sites, being a cropmark and the site of a possible medieval moat. The Amelioration Lands proposals would not affect any known archaeological sites.
- 2.6.10 There would be a range of potential effects on previously unrecorded archaeology as a result of a range of different construction works where there would be disturbance below ground level or disturbance to the sea bed. The floodplain, upon which the site is located, has been identified as being of high archaeological potential, in particular in relation to possible buried landscapes.
- 2.6.11 Further investigations would be carried out in advance of development of the site. The results of such work would help to develop an appropriate strategy for mitigation in the different parts of the port and dredge area. Mitigation would consider a range of measures including preservation of remains where they lie, to excavation and recording. The mitigation strategy would be prepared in consultation with the appropriate agencies prior to the commencement of development.
- 2.6.12 Predicted effects on unknown archaeology on the landward areas of the site will be refined through further investigation. It is considered that the effects on marine archaeology, notably wrecks, would be beneficial, as information would be obtained on a little known resource, which, without the development, would continue to decay through natural processes, ultimately to be lost.
- 2.6.13 No significant effects on known or unknown archaeological sites are predicted beyond the construction stage.

2.7 LANDSCAPE AND VISUAL EFFECTS

Introduction

- 2.7.1 A detailed assessment of potential effects on the landscape character and quality of the locality, and on views from roads, paths, residential areas and other viewpoints, has been undertaken. The broad study area comprised areas falling within a 10km radius of the site.
- 2.7.2 Landscape effects are those affecting the landscape's intrinsic quality; visual effects are those affecting the viewer and the view of the proposals.
- 2.7.3 The assessment has considered a full range of effects deemed likely to occur and divides the study area into a number of areas of different landscape character. It also identifies a zone within which the development would be visible, and assesses a range of views of the site. Effects during the construction stage and when the development was in use have been assessed.

Existing situation

- 2.7.4 In landscape terms, the site and its setting are dominated by the Thames Estuary itself, which comprises an open and exposed stretch of water bounded by extensive low-lying areas of mudflats, coastal river plain and industrial port and urban development. On either side the Estuary is physically contained by rising land.

Predicted effects

- 2.7.5 The assessment has identified a range of landscape character areas within the study area, which take in all the proposed aspects of the port development, including road and rail corridors and the Amelioration Lands. It has assessed each character area in terms of their landscape and visual quality and sensitivity to change. The areas have been assessed at different times of the year in order that summer and winter effects can be predicted. The port and associated works have then been assessed in terms of their potential effects on each character area.
- 2.7.6 Construction effects have been assessed in respect of the timing, duration and extent proposed activities, types and scale of plant and machinery involved and the gradual change in the appearance of the site as the port, transport infrastructure improvements and Amelioration Lands works were developed over the full period of the construction timescale. Operational effects have been assessed in relation to the completed development.
- 2.7.7 The key findings of the landscape and visual assessment are that the port would be located within an open coastal marsh landscape which is visually and physically contained by rising land on either side of the Thames Estuary. The nature of the wider landscape character means that both close up and more distant views would be possible, those more distant being from surrounding higher ground.

- 2.7.8 The Thames northern shoreline in general has a dramatic man-made character associated with a working Estuary. The proposed port development site has an industrial marsh/coastal fringe character and is assessed to be of low landscape quality and sensitivity. The port would be constructed on a combination of reclaimed river and previously developed river edge with few landward topographical features, and limited vegetation. This is also a distinctive characteristic of the surrounding coastal marshes.
- 2.7.9 The proposed road and rail improvements, other than the access road to the port, would primarily be aligned along and within existing road or rail corridors. The access road itself would cross an area of arable farmed land which is quite open in character allowing extensive views from the adjacent residential edges of Corringham and Stanford-le-Hope
- 2.7.10 Screening of the proposed larger development structures, in particular the quayside cranes would not be feasible but careful choice of colour for cranes would help to reduce their visual effects particularly in more distant views. The colours of container stacks and other cargo would inevitably be varied.
- 2.7.11 During the construction the majority of landscape and visual effects are predicted to be either non/negligible or minor adverse. Some moderate adverse temporary effects are predicted for areas nearest to the site on the north side of the Estuary, primarily relating to views of the site from areas adjacent and to the north of the site, particularly views from nearby footpaths. The effect on the landscape character of the river itself is also assessed as potentially moderate adverse.
- 2.7.12 When complete, the principal features of the port prominent in views would be the cranes and the container storage area with stacked containers. A range of minor landscape and visual effects are predicted, but a moderate adverse landscape effect is predicted on the river itself, together with moderate adverse visual effects for areas around East Tilbury, Coalhouse Fort and the coastal marsh areas between Gravesend and Cliffe.
- 2.7.13 The access road would be relatively prominent in views from the edges of the residential areas at Stanford le Hope and Corringham, to the west and north respectively and moderate adverse visual effects are predicted. The proposed road improvements would give rise to some minor adverse landscape and visual effects again on the areas to the north and west of the port site. The proposed rail improvements would not give rise to any adverse residual effects, and similarly the proposed Amelioration Lands would not create adverse residual effects, and beneficial landscape effects are predicted.
- 2.7.14 A Landscape Strategy is proposed which would have the effect of reducing adverse visual and landscape effects of the development and its supporting infrastructure to minor adverse in most cases, with a small number of moderate adverse effects.
- 2.7.15 Implementation of the Landscape Strategy would also lead to a number of beneficial visual and landscape effects of minor to moderate significance. These would be primarily related to new planting proposed along the road and rail corridors, since there would be limited opportunities for landscape measures visible from outside the site, on the port itself.

- 2.7.16 Following a lighting assessment, residual night-time effects are considered likely to be similar to those of Felixstowe port. Lighting at the port would be seen in the context the brightly-lit BP Coryton refinery which lies adjacent to the site, and in the historical context of the formerly brightly lit Shell Haven refinery closed in 1999.

2.8 AGRICULTURE

Introduction

- 2.8.1 The effect of the proposed port development on agricultural land has been assessed as part of the EIA. The proposed development would affect areas of agricultural land to the west of the refinery site, immediately to the south west, near Mucking Flats, and on the south side of the Estuary on the north Kent Coast near Halstow Marshes.
- 2.8.2 The assessment considered the loss of agricultural land arising from the link road and rail improvements which would affect some 55ha (137 acres) of agricultural land immediately west of the former refinery site, and the Amelioration Lands at Sites A and X, that would affect some 37ha (91 acres) and 282ha (697 acres) respectively. The port development itself would not affect any farmland.
- 2.8.3 The assessment has considered effects on agriculture in terms of the principle of loss of agricultural land in relation to national policy objectives, and the potential effect on local farm viability where land would be taken.
- 2.8.4 The nationally-used Agricultural Land Classification system (ALC) recognises five basic grades of land (from 1 to 5), with Grade 3 land being subdivided into categories 3a and 3b. The Best and Most Versatile Land (BMV) falls within Grades 1, 2 and 3a, while Grades 3b and below are classed as being of moderate to very poor quality. National land use planning policy seeks to avoid the loss of BMV land.
- 2.8.5 The assessment also considered effects in relation to the Essex Coast Environmentally Sensitive Area (ESA) and North Kent Marshes ESA which affect the proposed Amelioration Lands. The ESA designations encourage agricultural management favourable to the traditional features of the area with higher environmental value, notably coastal marshes and grazing marsh.

Existing situation

- 2.8.6 Most of the land which would be affected by the works is characterised by open, extensive, areas of traditionally-managed grassland intersected by networks of fleets, ditches and dykes, often with fringes or more extensive areas of reeds and rushes. An important characteristic of these grazing marshes is their close link with the intertidal areas of the Estuary and saltmarsh from which they originated and from which they are now separated only by the sea wall.
- 2.8.7 About 36% of the land surveyed to the west of the port site, through which the proposed link road would pass qualifies as BMV land. Of the remainder, about 57% is Grade 3b, and about 4% Grade 4. The Amelioration Lands have not been surveyed in detail for ALC, but based on mapped classification data, about 10% of Site A is Grade 3a, the remainder being Grade 3b, while at Site X about 37% is Grade 3b, the remainder being Grade 4.

Predicted effects

- 2.8.8 The link road would lead to the loss of 43ha (106 acres) of land in Grades 2 and 3a and would also be likely to result in the severance of some land, which has been assumed in the EIA to be effectively lost to agricultural use. This is considered to be a minor adverse effect.
- 2.8.9 One farm business (Old Hall Farm) would be affected by land loss. A financial assessment undertaken as part of the EIA has concluded that the farm would remain viable. It is owned by Shell and is let to an agricultural tenant.
- 2.8.10 Part of old Hall Farm, about 1ha, lies within the Canvey Island section of the Essex Coast ESA. The loss of this area is considered to be a minor adverse effect.
- 2.8.11 No adverse effects are predicted on agricultural land in respect of land use policy or farm viability as a result of the Amelioration Lands proposals, and a minor beneficial effect is predicted in respect of the ESA objectives at these sites.

2.9 TERRESTRIAL ECOLOGY

Introduction

- 2.9.1 The EIA has included an assessment of potential effects on the ecology of the former refinery and surrounding landward areas, including the Amelioration Lands, during the construction and operational phases of the development. Specific issues in respect of the ecology of the Thames Estuary have been considered separately.
- 2.9.2 A range of survey work has been undertaken, including field surveys for flora and specific habitats including grazing marsh, ditches, other vegetated areas and waste ground, and hedgerows. Specific surveys have been undertaken for badgers, bats, water voles, reptiles/amphibians, birds and invertebrates. Freshwater fish have also been considered specifically in the assessment.
- 2.9.3 The main issues that the assessment considered, arising from the EIA scoping process, surveys and consultations have been:
- a) the potential effect of the development on birds that could comprise part of the Bentfleet and Southend Marshes Special Protection Area (SPA) and the Thames Estuary and Marshes SPA populations, as these areas, designated at the European level, lie adjacent to the port development site;
 - b) the potential effect of the development on breeding birds within the study area;
 - c) the total ecological value of the study area, as well as designated areas present;
 - d) the drainage of the proposed development and how it could affect the surrounding ecology and nature conservation interests;
 - e) the potential effect of the proposed link road on habitats and particularly on over-wintering bird populations;
 - f) the potential loss of habitat and its effect on protected species within the study area;
 - g) the scope to improve the ecological value of existing habitats; and
 - h) ecological input into the overall design process.

Existing situation

- 2.9.4 The Thames Estuary is characterised by low-lying land bordering the River Thames, extending along much of the Kent and Essex coastlines. Dominant land types are marshland, grazing marsh, and former grazing marsh converted to modern agricultural uses. The main areas of interest at the site at present are the watercourses and the areas of grazing marsh and Estuary fringe areas to the west of the former refinery.
- 2.9.5 A range of key habitats have been identified within the boundary of the study area, including reeded ditches and dykes; coastal grazing marsh; open water; shingle; buildings and structures; hedgerow; trees and scrub. Within the former refinery there is limited habitat interest due to the developed nature of the site. Other areas, affected by the proposed road and rail improvements and Amelioration Lands are comprised largely of agricultural land, with more limited ecological value.

- 2.9.6 There are a number of statutory designated nature conservation sites adjacent to the proposed development areas, including Sites of Special Scientific Interest (SSSI) and confirmed and proposed SPA. These are outside the application boundary except for a small area of the Vange and Fobbing Marshes SSSI, which would not be affected by development, and the sea defence bank and fleets within Site X.
- 2.9.7 There are also a number of non-statutory nature conservation sites in the vicinity of the site comprising areas of meadow, marsh and reedbed and freshwater pool interest.

Predicted effects

- 2.9.8 Construction activity has the potential for a range of adverse ecological effects on both habitats and specific species. Key effects relate to direct land-take and disturbance, together with changes in drainage, and the potential for accidental spills of pollutants to occur.
- 2.9.9 Operational effects would effectively continue construction effects in the case of land take and other permanent changes, and would have the potential for disturbance from lighting at the site and from noise and movement associated with freight handling and transfer.
- 2.9.10 An extensive programme of mitigation measures is proposed for the construction and operational phases of the proposed port development responding to potential adverse effects. During construction, these include:
- a) production of plans showing sensitive areas of habitat and locations of sensitive/protected species to be protected during the construction phases;
 - b) management of the timing and phasing of works to avoid sensitive breeding and hibernation periods;
 - c) identification of alternative areas of habitat that would not be affected, and which could serve as potential receptor areas for affected species;
 - d) translocation of species to alternative habitat; and
 - e) implementation of appropriate construction practices as required through an Environmental Action Plan (EAP).
- 2.9.11 During the operational phases mitigation measures would include:
- Management of existing habitat***
- a) increasing the diversity of ditches and drains through planting with appropriate species;
 - b) re-planting species-rich hedgerows equivalent to the area lost;
 - c) upgrading (in ecological terms) of an area of the ESA from permanent grassland to wet grassland;
 - d) management of habitats through an integrated site management plan in conjunction with the ESA scheme; and
 - e) creation of a badger sett in existing territory.

Creation of new habitat

- a) development of new ditch habitats;
- b) recreation of an area of grassland and other appropriate habitat within the adjacent arable areas (Area 1); and
- c) creation of new suitable habitat for the species identified in sub-section

- 2.9.12 Following the implementation of proposed mitigation measures, it is predicted that there would be no adverse effects of greater than minor significance during the construction or operational phase. These would include some disturbance to bats and water voles during construction, loss of grazing marsh and water vole habitat, and some loss of habitat for breeding birds arising as a consequence of the removal of derelict buildings within the site.
- 2.9.13 Following mitigation, the ES identifies a number of areas where residual benefits would accrue through the improvement of habitat and the provision of new habitat. This would generate benefits for plant species, bats, brown hare, amphibians and reptiles.
- 2.9.14 The measures identified above to mitigate adverse effects and achieve beneficial effects include improving the nature conservation value of ditches and drains through appropriate planting; re-planting species-rich hedgerows; and maintaining habitat diversity and mixes. New habitats would be created by developing new ditch habitats and creating new habitat suitable for water vole and great crested newts.
- 2.9.15 There would be no direct effect on any statutory sites of nature conservation interest although there may be some indirect effect on waterfowl in the Thames Estuary and Marshes SPA and the Benfleet and Southend Marshes SPA.