1 INTRODUCTION

1. The Harwich Parkeston Quay Act 1988 authorises the construction of a quay wall, the construction of a culvert to divert the Dovercourt Dock River and the filling in of the area landward of the quay wall by reclamation or the completion of reclamation. Ancillary works within the limits of deviation of the quay wall and culvert are also permitted.

2. The 1988 Act permits the use of the reclaimed land as part of the harbour undertaking of Harwich International Port Ltd (HIPL) and has the effect of granting planning permission for the works. This consent was granted subject to a number of conditions and restrictions, the most notable of which were:

- All tidal works require approval by the Secretary of State; and,
- Planning permission deemed to have been granted under the Act is limited so as to expire after 15 years from the passing of the Act (that is, on or following 27 October 2003).

3. In 2000, Bathside Bay came into the ownership of HIPL, a subsidiary of Hutchison Ports (UK) Ltd (HPUK). Consequently, the relevant statutory powers to develop the Bay passed to HIPL and the company proposed to undertake the following:

- The construction of a quay wall;
- The reclamation of 65 hectares (ha) of intertidal area within Bathside Bay;
- The dredging of 4ha of intertidal area in Gas House Creek (at the eastern end of Bathside Bay) to create a harbour for small boats;
- Deepening and widening the approach channel to a depth of -14.5mCD (and -15mCD in the berthing area); and,
- The disposal of dredged arisings at a new offshore disposal ground.

4. Consistent with the requirements of the 1988 Act, HPUK and the Harwich Haven Authority (HHA) submitted a series of applications in late 2001 as follows:

- An application pursuant to Section 11 of the Parkeston Quay Act 1983 to permit the construction of a quay wall and reclamation of the intertidal area at Bathside Bay;
- An application under Section 34 of the Coast Protection Act 1949 for channel dredging and the disposal of arisings; and,
- Applications for licences under the Food and Environment Protection Act (FEPA) 1985 for construction of the quay wall and the deposit of materials.

5. Accompanying these applications, an Environmental Statement (ES) (hereafter referred to as the 'tidal works ES') was submitted in accordance with Regulation 4(6) of the Harbour Works (Environmental Impact Assessment) Regulations 1999. This followed a ruling by the Department for Transport, Local Government and the Regions (DTLR) (now the Department for Transport (DfT)) that the proposed tidal works required Environmental Impact Assessment (EIA) to be undertaken. The DTLR also concluded that the dredging component of the application for consent under Section 34 of the Coast Protection Act also required EIA.

6. In addition, early consultation indicated that it was the opinion of English Nature and the Environment Agency that the proposed works were likely to have a significant effect on the Stour and Orwell Estuaries Special Protection Area (SPA). Therefore, it is necessary under the Conservation (Natural Habitats &c.) Regulations 1994 ('the Habitats Regulations') for both the Secretary of State (in respect of the tidal works) and the local planning authority (in respect of the tidal works and all other development) to carry out an 'appropriate assessment' of the proposals.

7. In order to address this issue and the time limitation related to the planning permission under the 1988 Act, HPUK made an application for a Harbour Revision Order (HRO) under Section 14 of the Harbours Act 1964, seeking to extend the planning powers contained in the 1988 Act and to disapply Regulation 60 of the Habitats Regulations. Whilst HPUK's powers for interference with navigation rights and construction of a quay wall subsist after October 2003, the now imminent expiration of the planning powers granted under the 1988 Act and HPUK's desire to be clear and transparent with respect to their plans for development, have resulted in the decision to submit a series of planning applications for the proposed Bathside Bay development. Specifically, these comprise:

- A detailed planning application for the construction and operation of the proposed container port;
- A detailed planning application for the construction of a 'small boat harbour' in the vicinity of Gas House Creek; and,
- An application for Listed Building Consent for the partial demolition of the Train Ferry Gantry structure at Gas House Creek.

8. With the submission of these applications to Tendring District Council (TDC), the need to rely on the deemed planning consents conferred by the 1988 Act passes and the HRO (as submitted in March 2002) will formally be withdrawn. However, the application for tidal works, Coast Protection Act consent and licences under the Food and Environment Protection Act stand.

2 THE UK NEED FOR DEEPSEA CONTAINER HANDLING

1. The proposed Bathside Bay container port will meet a requirement for modern, efficient deepwater container handling capacity in the UK, for which there is a pressing need. The new deepwater facility will contribute to meeting the forecasted continuing strong growth in container traffic volume in the UK. It will provide substantial new capacity, be capable of handling the very largest vessels (which are taking an increasing share of the deepsea container trade) and serve as a transshipment hub port for the broader North European markets.

2. Through subsidiary companies, HPUK owns and operates three ports in the UK: Thamesport (a container terminal in Kent), Harwich International Port and the Port of Felixstowe. The ports of Harwich and Felixstowe are both located in the Harwich Haven and are collectively referred to as 'the Haven ports'.

3. UK ports are an essential part of the transport infrastructure on which the UK economy and many businesses depend. The importance of ports to the UK economy cannot be overstated. Currently around 95% of export/import goods, by volume, go

through UK ports. In 2000, this accounted for a trade of goods worth around £400 billion, compared to total Gross Domestic Product (GDP) of around £800 billion.

4. The UK economy is heavily dependent upon international trade in manufactured and semi-manufactured goods. This trade is already dominated by the container system. As the UK economy expands, the level of containerised imported and exported goods will continue to increase. Even with improved efficiency in existing terminals, this will generate a requirement for more container berths.

5. As well as handling the import and export of goods directly into and out of the country, a port can act as a gateway for direct deepsea container shipping to other parts of Europe, where goods are carried to their final destinations on shortsea trips. This is known as 'transshipment' or feedering, where the port acts as a hub. Transshipment traffic is an important and growing sector of the container market. Some lines engage in the shipment of containers from and to different deepsea trade routes and this is also referred to as transshipment.

6. Modern deepwater container handling facilities need to offer berths of no less than 14.5m below Chart Datum (CD), a high ratio of ship to shore quayside cranes for prompt discharge and loading of containers, and significant backup land and equipment for the stacking of containers in transit.

7. Ocean Shipping Consultants (OSC) Ltd have developed detailed projections of throughput growth for the major UK ports based on two cases of macroeconomic growth. A ‘base case’, which is considered over the longer term to be the most likely scenario, and a ‘low case’ which assumes a lower level of GDP growth. In the base case, throughput is forecast to increase by 59% to 8.47M Twenty-foot Equivalent Units (TEU) from 2001 to 2010 whilst, in the low case, volumes are forecast to grow by 46% to 7.80M TEU. By 2020, throughput will have reached 11.26 to 13.63M TEU, depending on the economic conditions.

8. One of the most significant trends shaping the deepsea container business has been the progressive increase in the size of vessels employed. In 2000, vessels of over 5,000 TEU capacity moved an estimated 0.91M TEU of deepsea (direct and transshipment) traffic through UK ports, or 20% of the total. It is forecast that this proportion will increase to 33% by 2010 and 48% by 2020.

9. On the basis of demand forecast (and increasing ship size within those forecasts), a clear national requirement has been identified for new deepwater container handling capacity. HPUK’s proposal to develop new capabilities in the Haven ports of Harwich and Felixstowe would provide a major part of the solution to meet the forecast demand:

- Bathside Bay container terminal will provide substantial new capacity and be capable of handling the very largest vessels that are taking an increasing share of the deepsea container trade;

- It is clear that the terminal will be highly competitive commercially and the operational expertise of HPUK will ensure maximised utilisation of proposed investments;

- The Harwich Parkeston Quay Act 1988 authorises the reclamation of Bathside Bay and some 30% of the Bay has already been reclaimed. The proposal to undertake the tidal works to reclaim the remainder of the Bay and the landside development completes the scheme authorised by the Act; and,

- The development of new port facilities at Bathside Bay that utilise existing infrastructure is supported at the regional, strategic and local planning policy levels in both existing and emerging strategy, subject to environmental safeguards.

10. Not providing this much needed facility would have a detrimental impact on the UK ports industry and could have potentially far-reaching adverse implications for the broader development of the UK economy.

11. Appendix 1 sets out further relevant data relating to the UK need case summarised above.

3 PROJECT DESCRIPTION

1. This section outlines the key features of the construction and operational phases of the proposed scheme. Although only the land-based aspects are of direct relevance to the planning application, the proposed tidal works and channel deepening are also briefly described. Figure 1 shows the Masterplan of the proposed development which includes the tidal works and the arrangement of the land-based aspects.

2. The construction phase is expected to last for a period of 5 years and will be undertaken in 3 phases. The phasing of the land-based development is shown in Figure 2.

3.1 CONSTRUCTION PHASE

3.1.1 Tidal works

1. The tidal works within Bathside Bay comprise the reclamation of 65ha of intertidal area above CD and the construction of a quay wall. In addition, an area of approximately 4ha (the majority of which is intertidal) in the Gas House Creek area will be dredged in order to accommodate small boat moorings that will be displaced from within Bathside Bay due to the tidal works. However, for the purposes of the ES, the tidal works are considered as comprising both of these areas, hence the area of intertidal affected by the tidal works is taken as being 69ha above CD.

2. The works also comprise the construction of a quay wall (including a cofferdam). The new wall will retain the reclamation material (sand and gravel) that will be pumped ashore from the deepening and widening of the approach channel. The quay wall will be constructed from the existing quay at Harwich International Port, extending for a distance of approximately 1400m eastwards along the line of the low water mark at Bathside Bay finishing short of the Train Ferry Berth. The construction of the quay wall and dredging works will be undertaken in Phase, with an expected duration of two and a half years.

3. A detailed plan of the tidal works, showing the proposed arrangement of the land-based development is provided in Figure 1. This plan shows 'the scheme' as assessed. Importantly, the figure shows the mitigation strategy proposed in relation to the predicted landscape impact of the development (see Section 3.1.5 for further details).

3.1.2 Dredging and disposal

1. The proposed dredging works comprise a series of phases. Firstly, silt will be removed down to the gravel surface over the channel area and in the area immediately behind the proposed quay face. Subsequently, the sand and gravel below the silt layer will be dredged and pumped ashore into the reclamation area. Finally, the stiff clay that lies beneath the sand and gravel layer will be dredged down to the required final channel depth of -14.5m CD. The berthing area adjacent to the quay face will be dredged to a depth of -15m CD.

2. It is proposed that the silt arising from the dredging works will be disposed of at the Inner Gabbard disposal ground (currently used for the disposal of maintenance dredged material). The sand and gravels arising from the dredging will be used in the construction phase of the reclamation. There will be no disposal of this material off-site.

4. The stiff clay will be disposed of at a new offshore disposal site. Currently, there is no accessible licensed site available for the disposal of this material in the vicinity of the works. The HHA has, therefore, made an application to the Department for Environment, Food and Rural Affairs (DEFRA) for a new capital disposal site to receive this material; Inner Gabbard (East).

3.1.3 Small boat harbour

1. In the tidal works ES, reference was made to the creation of a small boat harbour in the Gas House Creek area, at the eastern end of Bathside Bay. This harbour is required because the proposed container terminal will result in the displacement of the existing small boat moorings that are present adjacent to Bathside Bay. The principal components of the small boat harbour are:

- Engineering and reclamation works, including construction of a cofferdam wall and breakwater;
- Sheltered moorings for boats and wave wall;
- Slip way and boat storage/tender compounds;
- Public viewing and seating areas;
- Fishermen's store and fuel facility;
- Shortening the long berthing arm of the Train Ferry Berth; and,
- Site works including access road, car parking and lighting, fencing and landscape mounds.

2. The small boat harbour is shown in Figure 1.

3.1.4 Land-based development

1. Following the tidal works (described above), the land-based development will comprise the construction and/or installation of the following key features:

- 11 no. rail mounted quayside cranes 80m high in their 'boom down' position finished in blue, to serve four berths;
- 44 no. 'rubber-tyred gantry cranes' (RTGs) capable of lifting one container over 5 stacked containers. Height approximately 21m high, generally finished in blue;
- 3 no. rail gantry cranes approximately 20m high, generally finished in blue;
- Heavy duty container transfer area linked to the existing rail facilities;
- Terminal office accommodation (up to 11.6m high) and associated car parking;
- Terminal control gateway for vehicles entering and leaving the port facility, with a canopy up to 10.65m;
- Border inspection post building and X-ray facility;
- A logistics building 15.4m high, Mess Room up to 12.4m high, Workshop up to 16.2m high and Drivers' facilities building up to 3.35m high;
- Fishermen's store adjoining the new small boat harbour at Gas House Creek to accommodate the local fishing community;
- A rail terminal consisting of 8 parallel rail sidings to the rear of the operational area extending east-west across the site and includes an area of hard standing;
- A new sheet piled flood wall extending from Parkeston in the west to connect with the tidal defence level along the A120, in turn connecting to the existing and realigned defence mound at Gas House Creek. A small realignment of the gate through the defence wall is proposed at Gas House Creek to improve the approach to the new small boat harbour;
- Perimeter security fencing 2.4m high will be erected around the operational area;
- Timber post and rail fencing will be erected along the highway boundary to replace the existing security fence; and,
- A primary substation (144m^2 in area).

2. The land-based works will be constructed over 3 phases; this phasing is shown in Figure 2.

3. As part of the proposed landscaping works (see Section 3.1.5), it will be necessary to import topsoil to the site. It is proposed to source this topsoil from an agricultural area on the northern shore of Hamford Water, an inlet located approximately 2.5km to the south of the mouth of the Stour and Orwell estuaries. Topsoil will be available from this site as a consequence of proposals to create compensatory intertidal habitat (see Section 8) due to the predicted effect of the proposed port development on the Stour and Orwell Estuaries SPA (see Section 7.2).

3.1.5 Mitigation by design

1. A number of measures have been proposed in order to mitigate adverse impacts on the landscape and visual character of the area throughout the design process and are incorporated into the final layout of the scheme. The scheme design is illustrated in Figure 1.

2. The key principle of the mitigation strategy is the creation of a new landscape setting for the western side of the settlements of Harwich and Dovercourt. The new

setting comprises a wetland corridor which, in conjunction with open land at The Hangings, forms a new approach to Harwich on the A120 and establishes a buffer between the settlement and the proposed port. The urban treatment of the road corridor is extended to the edge of Harwich at Gas House Creek, encompassing a small boat harbour, a new publicly accessible quayside and viewing area, car park, boat store, fishermen's store building and seating area.

3. Approaching Harwich, the wide verge adjoining the A120 will be planted with a formal tree line which will establish a more attractive and appropriate approach to the town and extend up to the quayside of the small boat harbour at Gas House Creek.

4. The land north of Dovercourt, up to the A120, is to be retained and enhanced as an open space buffer in conjunction with the land north of the A120. The buildings fronting the A120, and within the buffer, have been designed as positive features in the landscape and approach to Harwich.

5. Consideration has been given to the design, location and tilt angle of the lighting and the height of the columns, with the objective of minimising light pollution. The lighting columns have, therefore, been designed to be as low as possible, with low cut off lanterns to minimise light spill and spot glare. A balance between minimising the height of light columns within the main container area and impacts on operational layout and number of fittings has been struck.

3.2 OPERATIONAL PHASE

1. The site operations and conditions during the operational phase will comprise the following:

- The movement and stacking of 5 No. 3m high containers to a maximum storage height of 15m. With an additional container capable of being lifted over 5 stacked containers by means of a rubber-tyred gantry crane;
- The movement and docking of large deep sea container vessels approaching the site from the North Sea, along the Stour estuary turning, as appropriate, within the width of the river;
- The movement and operation of 11 no. quay side gantry cranes along the quay side wall, 80m high in 'boom down' position and 113m high in their 'boom up' position. The cranes are rail mounted and can operate to service any vessel. The cranes are fitted with various safety lights;
- The movement, parking and loading of road haulage and the intensification of heavy truck movements on the road network;
- The movement of staff cars within the port facility;
- The splitting of incoming trains, shunted by diesel locomotives off the main electric rail line and on to the terminal;
- The movement and loading of containers onto trains on the proposed terminal, by overhead gantry cranes;
- The fumigation and statutory inspection of containers;
- The movement of containers stacked 1 unit high on trains. An additional 8 to 12 trains are expected to operate each day on the existing rail line between Harwich and Manningtree;
- Maintenance dredging campaigns to maintain deepsea access to the Port of Felixstowe currently occur every 10 to 12 weeks and will be extended to include

the approaches to the Bathside Bay container terminal. In addition, sediment replacement operations in the Harbour and Stour estuary will be extended, where the effect of the sediment plume typically disperses within one tidal cycle and the movement of vessels will increase the disturbance of the riverbed;
- The operation of lighting throughout the hours of darkness, illuminating the quay side, container handling and stacking area, car park and lorry park.

2. The main activity that will be undertaken at the port during the operational phase will be container handling. Once each imported container is off-loaded from a ship, using one of the rail-mounted quayside cranes, it will then be placed directly onto an IMV (Internal Movement Vehicle). An IMV is essentially a tractor unit with a trailer, which takes the container to a designated stacking location. The IMV drives alongside the container stack and under the RTG where the container is lifted off and placed in the yard. Outside hauliers would enter the Port at the Security Gate and be advised of the relevant container location. The haulier collects the container from the stack, with transfer again being made by an RTG. For the export of containers, the process works in reverse. The port will operate 24 hours a day, 7 days a week.

3. The volume of containers due for transhipment is expected to be 20% to 30% of the total number handled at the terminal. These containers would not exit the port.

4. At the new rail terminal, containers would be loaded and off-loaded from the railway wagons using rail mounted gantry cranes (RMGs). IMVs would move containers between the rail terminal and the stacking areas.

5. Hauliers arriving at the terminal would access and egress the Port through the main in-gate/out-gate, which would be manned 24 hours a day. There would be haulier traffic on and off the Port during the night but most hauliers would arrive during the day, with peak traffic flow occurring during the afternoon. There would be a haulier waiting area at the rear of the stacking area with facilities for lorry drivers, such as toilets.

6. All operations at the port will meet or exceed regulatory requirements, reflecting high standards of safety and best-practice.

7. The small boat harbour will be used mainly by pleasure craft but a number of users will be small fishing boats. The harbour will provide berthing facilities for at least 77 boats.

3.3 CONSIDERATION OF DESIGN ALTERNATIVES

1. As part of the design of the scheme and the EIA process, a range of alternatives were considered for the design and layout of the container port. In summary, alternatives were considered for the following aspects:

- Approach channel deepening and widening;
- Location of the capital disposal site;
- Layout of container handling and stacking areas;
- Strategy for undertaking reclamation;
- Design and number of quayside cranes;
- Layout and siting of the rail terminal;
- Phasing of the port construction;

- Offices and other operational buildings;
- Landscaping; and,
- Design of the small boat harbour.

2. Further details of the iterative design process undertaken to achieve 'best fit' are provided in Section 3.1.5, Mitigation by design.

4 THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

4.1 STUDY AREA DEFINITION

1. The study area has been defined based on the area over which the implications of the works have the potential to be detected; where this potentially varies from environmental parameter to parameter (e.g. noise and landscape). Figure 3 shows the broad study area - the Stour and Orwell estuaries, Hamford Water and the approaches to the Harbour - considered within the assessment.

2. With respect to physical and biological parameters, the study area relates to the zone of influence of any potential changes in the hydrodynamic and sedimentary regime and sensitivity of various environmental parameters (i.e. the Stour and Orwell estuaries).

3. In addition to the above, the study area includes the area over which the predicted effects of the land-based development (and its operation) have the potential to be detected.

4. For traffic, the main road that has the potential to be affected by vehicles associated with the development is the A120(T). During a six-month period of the construction phase, the B1414 Clacton Road/Oakley Road and the B1352 Ramsey Road/Church Hill will also be used to access the site; this is in order to move topsoil to Bathside Bay from a site on the northern shore of Hamford Water.

5. With regard to noise, the general localities that potentially could be affected are Harwich, Dovercourt, Parkeston, Shotley Peninsula and Felixstowe. These areas are, therefore, considered.

6. With regard to air quality, the study area has been defined to encompass predicted emission sources and the location of sensitive receptors.

7. For landscape and visual effects, the study area can be broadly defined as the Stour and Orwell estuary system based on the predicted extent of significant visual influence of the proposed development. This includes Harwich, the residential area of Bathside, Dovercourt (predominantly Dovercourt Conservation Area) extending along the A120 corridor and the village of Parkeston, as well as Felixstowe and Shotley across the estuary.

8. Other parameters, such as archaeology and heritage, water and sediment quality, land drainage, infrastructure and socio-economics all have more locally defined and distinct areas of influence which are encompassed within the broader study area defined herein.

4.2 PROJECT TEAM

1. The preparation of the Environmental Statement (ES), which reports the outcomes of the Environmental Impact Assessment (EIA) process (see Section 4.5), involved input from a variety of specialist organisations, managed and co-ordinated by Posford Haskoning (Environment). The project team comprised experts from:

- Posford Haskoning (ornithology, benthic invertebrates, fisheries, vegetation, water and sediment quality, land drainage, lighting, air quality, navigation, recreation, archaeology, infrastructure and risk);
- HR Wallingford (hydrodynamic and sedimentary regime);
- Bureau Veritas - Acoustic Technology (BVAT) (noise and vibration);
- Landscape Design Associates (LDA) (landscape and visual setting);
- Environmental Resources Management (ERM) (traffic and transportation);
- Alan Baxter and Associates (heritage);
- Fuller Peiser (planning context);
- Ocean Shipping Consultants (OSC) Ltd. (need); and,
- Roger Tym and Partners (economics).

4.3 FORMAT OF THE ES

1. The ES is arranged into 12 Sections and assesses the potential impacts of the construction and operational phases of the proposed development on the following parameters:

- Hydrodynamic and sedimentary regime;
- Benthic invertebrate communities;
- Ornithology;
- Saltmarsh, other coastal vegetation and coastal invertebrates;
- Fisheries resource;
- Commercial fishing activity;
- Water and sediment quality;
- Landscape and visual setting;
- Air quality;
- Noise;
- Vibration;
- Commercial and recreational navigation;
- Land-based recreation;
- Marine archaeology;
- Heritage;
- Land drainage and flood defence;
- Traffic and transportation;
- Infrastructure; and,
- Socio-economics.

2. A number of Appendices are included within the ES which contain background information and include correspondence with the Regulators (Appendix 1), a risk assessment concerned with the movement of hazardous substances (Appendix 7) and a marine traffic analysis (Appendix 8). In addition, a series of Supporting Documents (SD)

(1 to 8) (published separately) also accompany the ES. The subject of these documents is as follows:

- SD1: Disposal of Dredged Material;
- SD2: Hydrodynamic and Ecological Assessment: Supplementary Reports;
- SD3: Biological and Fisheries Data;
- SD4: Landscape and Visual Impact Assessment;
- SD5: Air Quality Assessment;
- SD6: Noise and Vibration Assessment;
- SD7: Harwich Train Ferry Berth; and,
- SD8: Economic Impact Assessment.

3. The ES is also accompanied by a comprehensive Transport Assessment.

4.4 CONTEXT OF THE ASSESSMENT

1. The ES has been prepared to accompany a planning submission under the Town and Country Planning Act 1990 and has, therefore, been prepared in accordance with the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999. The ES addresses the environmental implications of the land-based aspects of the proposed development. For completeness, the ES also addresses those issues that are relevant to the tidal works and channel deepening.

2. Given the nature of the proposed development, HPUK determined that an EIA would be required (and a formal screening opinion was not sought). In November 2002, a formal request for a scoping opinion under Regulation 10(1) of the above Regulations was made to Tendring District Council (TDC) by HPUK. An opinion was received from TDC in December 2002 which detailed the scope of work to be covered by the EIA process. All items identified have been subsequently addressed in this ES.

4.4.1 Planning policy context

1. The following sub-sections summarise the main environmental planning policies relevant to the proposed development of Bathside Bay.

2. Relevant National Planning Policies, in the form of Planning Policy Guidance Notes (PPGs) or White and Green papers, are reflected in the policies set out below.

Regional Planning Guidance

1. Regional Planning Guidance for East Anglia to 2016 (RPG6 2000) and Regional Planning Guidance for the South East (RPG9 1994) provide the most up-to-date guidance for the east of England.

2. RPG9 covers Essex, Hertfordshire and Bedfordshire, and identifies Harwich and Clacton as priority areas for regeneration. The Guidance also identifies the need for a fully integrated freight distribution system which makes the most efficient and effective use of road, rail, inland waterways and coastal shipping. Harwich is identified as being a Regionally Significant Port. RPG9 specifically addresses the sustainable development of seaports. It states that the sustainable development of seaports and port facilities should be supported for international deepsea, shortsea and coastal shipping and that

local authorities, port authorities, the shipping industry and other interested parties should work in partnership to produce development strategies for port facilities and access to them which are sustainable and make best use of existing facilities. The RPG specifically refers to the Tendring coast as a priority area for regeneration and states that Harwich requires investment in its port infrastructure and its links to other areas.

3. Regional Planning Guidance for the East of England (RPG14) will eventually supersede the current position. A consultation document issued in September 2002 titled Consultation Options Leading to Regional Planning Guidance for the East of England (RPG14), identifies the Haven Gateway as a possible sub-region. It states that *"The Haven Gateway offers potential for economic growth based upon high tech knowledge-based activities in Ipswich and its emergent links to the Cambridge sub-region, coupled with continuing economic regeneration needs in Harwich and the Clacton coastal area"*. It acknowledges that environmental issues would need care and attention.

Essex and Southend-on-Sea Replacement Structure Plan

1. The Essex and Southend-on-Sea Replacement Structure Plan was adopted in April 2001. The Plan covers the period 1996 to 2011. Within this Plan the strategic priority for the eastern districts of both Maldon and Tendring is to improve employment opportunities. Tendring, in particular, is identified as having structural unemployment problems.

2. The Plan also supports the provision of improved port facilities at Harwich International Port at its existing site and through the future development at Bathside Bay (Policy BIW10).

Tendring District Local Plan

1. The Tendring District Local Plan was adopted in April 1998 and covers the period up to 2001. It is currently under review.

2. In the adopted Local Plan, Policy HAR28 allocates Bathside Bay as an area suitable for mixed use development, comprising port developments, housing, industry/warehousing and business park, retail park, hotel and leisure complex, public open space/gardens, primary school, local shops and community centre, heritage centre and mooring basin. This allocation reflects an outline planning permission (reference TEN/2099/89) approved by TDC, which has now lapsed. Notwithstanding this application, the Plan acknowledges (14.13.1) that the outline planning permission for development of the site does not affect the Parliamentary approval for the development of the Bay (Harwich Parkeston Quay Act 1988).

3. In addition to the mixed-use allocation HAR28, the western part of Bathside Bay is identified as being within Harwich Port's operational area. Policy HAR15 confirms that the Planning Authority will support the continued development and expansion of local port facilities in Harwich and Parkeston.

4. The north eastern part of the site is located within the Harwich Conservation Area. Policies in the Plan seek to preserve and enhance the character and appearance of the Area. The Council has published an Enhancement Scheme for the Harwich

Conservation Area, which has been formally adopted as Supplementary Planning Guidance and to which the Council have due regard in assessing development proposals (Policy HAR16).

5. There are policies in the Plan to support proposals for the transport of freight by water in appropriate locations, providing that the proposals do not involve extensive storage or have other adverse environmental implications (Policy TT11). Proposals within or adjacent to Special Landscape Areas and within or adjacent to Sites of Special Scientific Interest (SSSI) will not be considered acceptable.

6. The Plan identified the need for an alternative road access to the port to relieve congestion on Station Road and to improve environmental conditions in Parkeston Village. Paragraph 14.9.6 states that negotiations have taken place between the various parties over a bypass to serve the port and will provide full traffic relief for the village. This has now been implemented.

7. The Council supports (paragraphs 14.9.2 and 8.3.5) the upgrading of the A120 between Bentley and Harwich to dual carriageway standard.

Conclusion

1. The development of new port facilities at Bathside Bay that utilise existing infrastructure is supported at the regional, strategic and local planning policy levels in both existing and emerging strategy, subject to environmental safeguards. These environmental safeguards are the subject of the ES.

4.5 THE EIA PROCESS

1. EIA is a tool for systematically examining and assessing the impact and effects of development on the environment. The outcome of the EIA process is reported in an Environmental Statement, which typically contains the following information:

- Description of the development proposal (alternative development options considered);
- The 'baseline' environment that the development will affect;
- Prediction of 'impact' on that baseline and assessment of significance of subsequent effects;
- Prescription of mitigation measures to avoid, reduce or remedy such effects; and,
- Non-technical summary (NTS) – which this document represents.

2. In addition, it is the opinion of English Nature that the proposed scheme is likely to have a significant effect on the Stour and Orwell Estuaries Special Protection Area (SPA) a site designated for its European nature conservation interest. Therefore, under Regulation 48 of the Conservation (Natural Habitats &c.) Regulations 1994, 'appropriate assessment' is required to determine whether an adverse effect on the 'integrity' of the European site is likely to arise as a result of the works.

4. The ES upon which this summary is based presents the results of the assessment of the environmental implications of all components of the proposed scheme, including the planning applications for the Bathside Bay Container Port, the Small Boat Harbour and the Listed Building Consent, and reflects previous work

undertaken with respect to the tidal works and the channel deepening. It also provides the information required for appropriate assessment.

5 EXISTING ENVIRONMENT

1. In order to assess the potential impacts associated with all aspects of the proposed development, the nature and sensitivity of the existing environment of the study area has been described.

5.1 HYDRODYNAMIC AND SEDIMENTARY REGIME

5.1.1 Approach

1. The impact of the proposed development on tidal flows and the movement of sediment in the Stour and Orwell estuaries were investigated using an approach that has been developed over a number of years. Because of the scale of the proposed development, further field data was collected to build on our understanding of the estuarine environment in the vicinity of the Harbour and, in particular, in the lower Stour estuary where the works are to take place. Field measurement included tidal flows, suspended sediment, intertidal bed levels and wave action. This data was then used to inform the computational modelling carried out to predict the impacts of the proposed development. HR Wallingford's approach to the modelling was to build upon existing methods applied to the estuarine system in conjunction with state-of-the-art modelling of wave conditions throughout the Harbour and Stour estuary (the areas most affected by the works) and three dimensional tidal flow modelling within the Harbour area itself.

5.1.2 Water levels

1. The tides at Harwich have a range of approximately 3.6m on mean spring tides and 2.3m on mean neap tides. The highest astronomical tide is 4.4m above CD and the lowest astronomical tide is 0.2m below CD. With distance upstream the tidal range increases in both the Stour and in the Orwell rising to 3.9m on mean spring tides at Mistley in the Stour and at Ipswich in the Orwell.

2. In the offshore area, the tidal range increases southwards (with proximity to the Thames).

5.1.3 Tidal currents

1. Peak current speeds at the mouth of the Stour estuary, i.e. in the vicinity of the proposed development, are 1m/s (2 knots) on the ebb tide and 0.7m/s (1.4 knots) on the flood tide. Tidal currents reduce with distance upstream. Except for the part of the Stour Estuary around and upstream of Mistley, peak currents are higher on the ebb than on the flood tide.

2. Peak currents in the Orwell estuary are slightly reduced from those of the Stour, with current speeds at the mouth of the Orwell increasing up to 0.8m/s (1.6 knots) on the ebb of mean spring tides and up to 0.65m/s (1.3 knots) on the flood. Like the Stour, ebb tide currents are generally higher than those on the flood, except around and upstream of Woolverstone where flood tide currents become higher than those of the ebb.

3. In the Harbour, tidal current speeds are greater than in the Stour and Orwell with peak ebb currents of up to 1.5m/s and peak flood currents of up to 1m/s.

4. In the offshore area, tidal currents run approximately parallel to the coast and demonstrate ebb-dominance. Current speeds are higher offshore than near the coast, reaching approximately 2.0 knots (1m/s) on a mean spring tide around Roughs Tower and in the Shipway channel (Figure 3). Peak ebb current speeds are typically slightly faster than peak flood speeds throughout the area, while current speeds on neap tides are typically two thirds of those on spring tides.

5. The flow in and out of the Stour and Orwell system, combined with the shape of the coast between Felixstowe and the Naze, leads to complicated patterns of tidal currents. On the flood tide, the water enters a long eddy on the Harbour side of the spit. A separation point occurs offshore, with water more than 2km offshore of Felixstowe passing the Harbour mouth to flow past Dovercourt Beach. On the ebb phase, the outflow from the Harbour initially heads eastward in the inner part of the channel, then curves to the north-east.

5.1.4 Wave conditions

1. Waves in the Stour and Orwell estuaries are mainly generated locally as a response to wind action and so are generally relatively small. Waves in the Stour are typically of the order of 0.2 to 0.3m high but strong westerly winds can generate waves of over 1 metre throughout much of the estuary. In the Orwell, waves are generally smaller, being typically of the order of 0.1 to 0.2m in height. Some swell waves also propagate from offshore through the mouth of the Harbour into the lower part of the estuaries.

5.1.5 Sediment transport and dredging

1. In the Felixstowe berths and approaches, large volumes of maintenance dredging are undertaken. Based on comparisons of sequential bathymetric surveys of the harbour area, the average rate of sediment accumulation is about 8,000m^3/day (the equivalent of 2.8Mm^3/year). In response to the 1998/2000 channel deepening, it is predicted that the rate of siltation in the Harbour will increase to 9,000m^3/day (the equivalent of 3.3Mm^3/year). The present rate of siltation is, therefore, given as 2.8 to 3.3Mm^3 per year.

2. The HHA manage and record the maintenance dredging activity carefully and, working with the Dredging Contractor over recent years, have refined the dredging methods and technologies involved. This has meant that the actual method of dredging has become an important part of the sediment budget for the estuary system. At present, the dredging practice results in only 72% (dry mass) of the sediment that accumulates in the harbour area being placed in the dredgers for subsequent disposal. The remaining 28% is dispersed within the harbour.

3. Since 1998 a programme of sediment replacement has been introduced to offset the impacts of the channel deepening on the intertidal areas of the estuaries. This programme returns a further 10% of the material that accumulates in the harbour back into the estuary system. This has been achieved by placements in the Harbour (at

North Shelf), as well as subtidal placements and water column recharge in the Stour estuary. The resulting effect of current dredging practice and sediment replacement is that the present mass of maintenance material annually taken offshore for disposal is around 1.1M dry tonnes, the same as that prior to the 1993/94 channel deepening.

5.1.6 Erosion of the intertidals

1. The intertidal areas of the Stour estuary (defined as being above 0m CD) are at present eroding at an average vertical rate of about 13mm per year. This is the result of natural processes that have been ongoing ever since the die-off of eelgrass in the 1920s, which led to erosion throughout the estuary. The rate of erosion is greater in those intertidal areas nearer the channel than those nearer land (i.e. in the lower parts of the intertidal).

2. The present rate of erosion in the Stour is equivalent to the loss of 13.2ha/year of intertidal area. The combination of changes to the management of dredging operations together with the impact of the 1998/2000 channel deepening is predicted to increase this erosion rate by 0.1ha/year. Prior to this, it is predicted that the combination of changes to the management of dredging operations, works in the Harbour and the 1993/94 deepening will have reduced net erosion from 13.5ha/year to 13.1 ha/year.

3. In the Orwell the picture is more mixed; the lower Orwell is eroding at rates comparable with those in the lower part of the Stour, but upstream of Collimer Point the Orwell is experiencing accretion. Evidence indicates that the Orwell has not experienced the mass erosion that has occurred in the Stour and has been fairly stable overall for hundreds of years.

4. On balance, there is ongoing net accretion in the Orwell, equivalent to a gain in intertidal area above 0m CD of about 3.7ha/year. The combination of changes to the management of dredging operations together with the impact of the 1998/2000 channel deepening is predicted to reduce intertidal accretion by 0.1ha/year and the combination of changes to the management of dredging operations, the works in the Harbour and the 1993/94 channel deepening are predicted to have reduced net accretion by 0.2ha, from 4.0ha/year to 3.8ha/year.

5. Overall the Stour and Orwell estuary system is expected to have been losing intertidal area above 0m CD at a rate of 9.5ha/year in 1986, 9.3ha/year in 1997 and 9.5ha/year currently. However, given present dredging practice and the sediment replacement programme, it is predicted that there has not been an increase in the rate of erosion of intertidal areas since the channel deepening of 1993/94. Thus the effect of the 1998/2000 channel deepening, which is proportional to the amount of sediment removed from the system, remains at the pre-1993 level.

6. Erwarton Bay and Shotley represent the intertidal areas most local to the proposed development. Erwarton Bay is typical of the intertidal areas of the Stour Estuary, experiencing greater erosion near the lower part of the intertidal and relative stability on the upper parts. Shotley intertidal is experiencing rapid erosion of 50 to 60mm a year, partly because of its more exposed position with respect to wave action.

5.1.7 Sea level rise

1. The present rate of sea level rise is not known for the study area. Analysis of tide level gauge data from the Permanent Service for Mean Sea Level Rise suggests sea level rise at Harwich of 3.6mm/year and sea level fall at Felixstowe Pier of the order of 4.5mm/year.

2. For the EIA, the current DEFRA guidance with regard to future rates of sea level rise for assessing flood defence works was adopted. This guidance assumes that, in the future, sea level will rise at 6mm/year. If it is assumed that erosion of the estuaries continues at the same rate as now, then the combined effect of the sea level rise and the ongoing erosion will be to increase wave action, leading to increased rates of erosion. This will be exacerbated by the predicted increases in storminess associated with global warming.

5.2 BENTHIC INVERTEBRATE COMMUNITIES

1. A combination of different sources of information was used to describe the intertidal and subtidal benthic invertebrate resource of the Bathside Bay area and to put this into context with the remainder of the estuarine system. These sources comprise:

- A survey of the Stour and Orwell estuarine system undertaken by Unicomarine on behalf of the HHA in 1997;
- A survey of the intertidal and subtidal area within the footprint of the development (tidal works and dredging) undertaken by Posford Haskoning in February 2001; and,
- A survey of the intertidal areas of the lower Stour Estuary undertaken by Posford Haskoning in July 2001.

2. The data collected from the above (comparable) surveys were used to describe a number of attributes of community structure, comprising species richness, species diversity, overall abundance and total biomass.

3. Statistical methods were used to analyse the data and to identify differences in species assemblages within Bathside Bay and throughout the estuarine system. Invertebrate analysis showed that the communities present in the vicinity of Bathside Bay are similar in nature to those present within the majority of the remainder of the estuarine system.

4. Based on the data collected from the surveys, biotopes were assigned in order to categorise the communities present. The intertidal area at Bathside Bay is largely dominated by the ragworm *Hediste diversicolor* and the Baltic tellin *Macoma balthica*. The subtidal sites are dominated by the polychaete worm *Aphelochaeta marioni* and oligochaetes (*Tubificoides* spp.), although a range of Polychaeta are also present. The substratum is comprised of soft mud, although at a number of sites the mud was cohesive and clay-like. These communities are widespread throughout the intertidal and subtidal zones of the estuarine system. It was, therefore, concluded that Bathside Bay's benthic invertebrate resource is typical of the system as a whole and is of comparable value in terms of diversity and abundance. There are, however, some localised variations in community structure; for example, the community within the existing approach channel to Bathside Bay is relatively impoverished.

5.3 ORNITHOLOGY

1. The majority of the Stour and Orwell estuarine system is designated as a Site of Special Scientific Interest (SSSI) under the Wildlife and Countryside Act 1981, Special Protection Area (SPA) under the EC Wild Birds Directive (79/409/EEC) and a Ramsar site under the 1972 Ramsar Convention on wetlands of international importance. The site qualifies as a SPA under Article 4.1 of the Directive by supporting notable numbers of overwintering golden plover (*Pluvialis apricaria*), a bird species included in Annex 1 of the Directive. This qualification was based on bird counts from three of the five winters from 1986/87 to 1990/91. Under Article 4.2 of the Directive, the estuaries also qualify as a SPA because they support internationally and nationally important populations of the overwintering bird species (Table 1). The site further qualifies under Article 4.2 for its overall waterfowl assemblage.

2. Bathside Bay is currently outside of the boundary of the SPA, although it has been proposed for designation as a SSSI and for inclusion within the Stour and Orwell Estuaries SPA. An assessment of the importance of Bathside Bay as a roosting habitat for waterfowl was made based on data collected as part of the Wetland Birds Survey (WeBS) over the most recent five winters for which data was available (1995/96 to 1999/00). The assessment showed that Bathside Bay is of most importance for 3 species of wildfowl; dark-bellied Brent geese, shelduck and mallard. Overall, over the period 1995/96 to 1999/00, Bathside Bay supported 3.1% of the total wildfowl in the Stour and Orwell estuarine system.

3. The bay was found to be relatively more important for roosting waders than wildfowl, supporting 6.6% of the estuarine wader population during the winter and 1.9% and 4.3% during the spring and autumn respectively. The bay is of most importance for oystercatcher, ringed plover, knot, sanderling and dunlin, supporting a maximum five year mean peak of 29.5%, 19.4%, 6.7%, 100% and 6.2% of the estuarine population for these species respectively.

4. Bathside Bay supported 2.2% and 2.4% of the waterfowl population of the estuarine system in 1999/2000 and 2000/2001 respectively; the Bathside Bay count sector occupies 2.8% of the total counted area of the estuarine system. Therefore, Bathside Bay is of comparable importance overall in terms of the total feeding waterfowl population (all species) it supports in relation to the remainder of the estuarine system.

Table 2 Internationally important populations of regularly occurring Annex I and migratory bird species in the Stour and Orwell Estuaries SPA for the five year period 1986/87 to 1990/91

Bird species	Average peak counts (1986/87 to 1990/91)	British, European, International Context
Golden plover (*Pluvialis apricaria*)	(Annex 1 species)	>1% British population
Dunlin *(Calidris alpina)*	23,760	>1% east Atlantic flyway population >5% British wintering population
Shelduck *(Tadorna tadorna)*	2,670	1% north west European population >3% British wintering population
Dark-bellied Brent Goose *(Branta bernicla bernicla)*	2,640	>1% international population >2% British population
Redshank *(Tringa totanus)*	2,520	>2% east Atlantic flyway population >3% British population
Grey Plover *(Pluvialis squatarola)*	2,170	>1% east Atlantic flyway population >10% British population
Black-tailed Godwit *(Limosa limosa)*	1,610	>2% east Atlantic flyway population >33% British population
Turnstone *(Arenaria interpres)*	880	>1% east Atlantic flyway population >1% British population
Ringed Plover *(Charadrius hiaticula)*	700	>1% east Atlantic flyway population 3% British population

Source: English Nature, 2001

5.4 SALTMARSH, OTHER COASTAL VEGETATION AND COASTAL INVERTEBRATES

5.4.1 Saltmarsh resources in the Stour estuary

1. Almost half of the original area of saltmarsh in the Stour Estuary was lost between 1973 and 1988. Only 5% of the loss is due to reclamation, notably in the Harwich area, where Spartina marsh has been covered by dredged material. 44% of the original (1973) area eroded were pioneer communities, mainly based on communities of scattered *Spartina* and large proportions of *Salicornia* beds. *Spartina*, *Aster* and *Salicornia* communities were also lost from the fronting marsh along the entire length of the estuary.

2. Between 1988 and 1997 the pace of saltmarsh erosion had reduced threefold when compared to the rate for 1973 to 1988 and losses from net erosion were of the

same magnitude as losses from reclamation activities (notably in Bathside Bay). In terms of percentages the rate of loss of intertidal reduced from 2.6% a year to 1.8% a year.

5.4.2 Saltmarsh resources in the Orwell estuary

1. Over the period 1973 to 1988, erosion was responsible for the loss of about 33% of the Orwell saltmarsh area, the majority of which was from the pioneer zone (74%) at the seaward edge of open stretches at Trimley marshes and Shotley Point. Large areas of pioneer marsh communities were lost at Levington Creek and Woolverstone Park. Although 74% of the pioneer zone was eroded, the majority of the remaining marsh in these locations was still occupied by pioneer communities by 1988.

2. Between 1988 and 1997 the pace of saltmarsh erosion had almost halved when compared to the rate for 1973 to 1988. In percentage terms, the rate of loss of intertidal reduced from 2.2% a year to 1.7% a year.

5.4.3 Saltmarsh resource within Bathside Bay

1. A survey of the saltmarsh within Bathside Bay was undertaken by Posford Haskoning in 2001; within each different stand of vegetation species abundance was recorded. A total of 6 species were identified during the course of the survey: *Salicornia europaea*, *S. perrennis, Puccinellia maritima, Atriplex portulacoides, Spartina* sp. and *Spergularia media*, all of which are relatively common and widespread around the coast of East Anglia.

2. A walkover survey of the conspicuous flora on previously reclaimed areas of land around the fringes of Bathside Bay was also undertaken by Posford Haskoning in September 1999. The survey found that the species present are typical species often encountered in coastal regions. Furthermore, the floral assemblages at the eastern and western ends of the bay are very similar.

5.4.4 Coastal vegetation

1. Probably of greater importance than the extent of saltmarsh at Bathside Bay is the uninterrupted transition from saltmarsh to terrestrial habitats in which there remains a slight maritime influence. On this site, the transition from saltmarsh to maritime terrestrial habitat occurs behind and in the ‘lee’ of the sand and shingle spit and in the south-western corner of the bay.

2. The plant communities of the spit area are all common and widespread coastal vegetation types, with two exceptions; the open, low and dry form of *Elytrigia atherica* saltmarsh and the non-NVC *Plantago coronopus* dominated grassland. These may be of some local nature conservation interest.

3. Three plant species which are Nationally Scarce and a number of plant species which are notable in an Essex context are present within the site. On the reclaimed area *Catapodium marinum* (rare in the county) and *Vulpia myuros* (uncommon but widespread in Essex) are present. These two species are present in the vegetation of the east, south and west of the bay

4. Bathside Bay as a whole, therefore, is at least locally important in habitat, plant community and plant species terms.

5.4.5 Coastal invertebrates

1. Invertebrate habitats at Bathside Bay are clearly limited. The bulk of the western part of the site has been levelled, probably capped and is devoid of intrinsic invertebrate interest. At the same time, there is a considerable degree of interest concentrated in the few remaining areas of semi-natural vegetation, primarily at the eastern end of the site but also in the sand and gravel ridge on the west side of the bay and on the spit in the north-east.

2. There is a reasonable complement of species with a conservation status, totalling nine Nationally Notable species and 30 Nationally Local species. Although none of the recorded species are listed in the UK Red Data Book, one (the spider *Haplodrassus dalmatensis*) is listed as Threatened in Essex and another (*Typhochrestus digitatus*) is considered to be a Threatened species in the county.

3. For two more species (*Pardosa agrestis* and *Zodarion italicum*), Essex populations are regarded as Regionally Important in south-east England. The spider *Haplodrassus dalmatensis* is only otherwise recorded in Essex at Colne Point, and has a strong association with sand dunes. The spider *Zodarion italicum* was discovered as new to Britain in Essex only a few years ago. It has a very restricted distribution in Britain, being confined almost entirely to the Thames estuary with a few outliers.

5.5 FISHERIES RESOURCE

1. Beam trawl surveys of fish and shrimp populations within the Stour and Orwell estuaries have been commissioned by the HHA. Monthly surveys were undertaken by Unicomarine Ltd from June 1999 to June 2000; these surveys recommended in December 2001 on a bi-monthly basis.

2. A number of species of commercial importance were sampled during the surveys. These species are primarily sole *Solea solea* and, depending on the market demand, brown shrimp *Crangon crangon*. Other incidental species present of commercial interest are eels *Anguilla anguilla*, bass *Dicentrarchus labrax* and grey mullet (Harwich Fishermen's Association, *pers. comm*.).

3. During 2002, the presence of the native flat oyster *Ostrea edulis* was discovered. This species was found to occur in the middle reaches of the Stour Estuary, notably within Holbrook Bay, Jacques Bay and up to Ballast Hill. In addition to being a commercially targeted species, *O. edulis* is of high biodiversity value and is the subject of a Biodiversity Action Plan (BAP).

5.6 COMMERCIAL FISHING ACTIVITY

1. A recent report on commercial fishing activity in the Stour and Orwell estuaries indicated that there are 21 full time vessels operating from the Harwich Harbour area. These vessels are based at Harwich, Shotley and Levington. Fishing within the harbour represents only part of the commercial activity. Of the vessels based at Harwich, 6 under 10m vessels concentrate fishing effort on sole *Solea solea*, cod *Gadus morhua*

and bass *Dicentrarchus labrax.* Eight vessels use the otter trawl method in the summer months, fishing mainly for Dover sole. The sole fishery is considered to be of most importance to local fishermen. Historically, there has been a sizeable fishery for brown shrimp *Crangon crangon* and pink shrimp *Pandalus montagui*. However, since 1995, there has not been any full time shrimp fishery due to the low numbers of these species present.

2. Monitoring of commercial fish catches was undertaken within the Stour and Orwell estuaries during trawling on 44 days between April 2000 and October 2000. This monitoring found that the highest average catch per hour over the period of the trawls was in the lower Stour Estuary, although the figures for the upper Stour Estuary and lower Orwell Estuary were not dissimilar.

5.7 WATER AND SEDIMENT QUALITY

1. Water quality data collected by the Environment Agency shows that the mean concentration of all metals, with the exception of zinc, is below 2μg/l. The reason for the higher level of zinc is, probably, that it is naturally more prevalent. Low concentrations of cadmium and mercury are also normal as these metals are less abundant naturally.

2. There is little variability in pH, salinity and temperature. This is probably due to the fact that the Agency's monitoring station is near to the mouth of the estuary and is, therefore, likely to be fully saline for the majority of the time and influenced little by freshwater inputs.

3. The sediments within and adjacent to Bathside Bay are thought to be relatively unaffected by significant historical industrial discharges. However, in order to assess the quality of the sediments within the intertidal area in Bathside Bay and the subtidal area in the vicinity of the bay, 23 sediment samples were taken and analysed. The analysis was undertaken by CEFAS. A range of determinands were measured, including:

- A suite of heavy metals;
- Organotins (tributyl tin (TBT) and dibutyl tin (DBT)); and,
- Particle size distribution.

4. In the absence of published UK sediment quality guidelines, the sediment quality of the samples at Bathside Bay has been assessed in relation to the Canadian interim sediment quality guidelines (ISQGs). This assessment shows that for the majority of samples from Bathside Bay, the concentration of cadmium, chromium, mercury and zinc is less than or equal to the ISQG level. However, the concentration of arsenic, copper and lead is above the ISQG level for the majority of samples; although none of the samples exceeded the probable effects level (PEL) for any metal. Above the PEL, the incidence of adverse biological effect increases.

5. Based on previous experience of contaminated sediments in other UK estuaries, the TBT and DBT concentration of the sediments at Bathside Bay can be considered to be relatively low.

5.8 LANDSCAPE AND VISUAL SETTING

1. The site of the proposed development is located on the eastern end of a peninsula, on the southern shores of the River Stour. Bathside Bay lies to the north of Dovercourt, west of the historic town of Harwich and east of Parkeston. To the north and across the estuary, Shotley Gate lies some 1km distant over-looking the site from slightly elevated land. To the east, Felixstowe and the deep-sea container port lie within 1.5km of the site (see Figure 4).

2. Immediately to the west, the site closely adjoins Harwich International Port (HIP), a busy passenger and freight port which is a dominant feature in the area. To the east, Harwich (characterised by a series of piers and quays) extends into the estuary. Low key riverside facilities fringe the western and northern edges of Harwich giving an untidy and unresolved appearance. Parkeston has an extensive industrial character; Harwich quay a quiet commercial character. The Port of Felixstowe is a large industrial area with a dominant impact on the estuary and is clearly visible along the River Stour and from the site and surrounding settlement.

3. The study area is characterised by a rural character with land in arable production or laid to pasture to the far west of the site, beyond Harwich International Port, and industrialised and settled landscape to the east, with Dovercourt and Harwich forming a large and relatively dense settlement extending along the peninsula.

4. The railway line extends along the northern and western edge of Harwich and Dovercourt and the train service is relatively infrequent. Freight trains depart from the terminal west of Parkeston. Only limited freight movements currently occur since the regular container service ceased in December 2000.

5. The main road based traffic utilises the new A120 Harwich Bypass and the B1352, the former arterial road connecting Harwich to the old A120. The influence of traffic on the A120 in the local and immediate study area is minor.

6. The study area encompasses a large number of port related structures and buildings which have a material impact on its character, including the oil refinery west of Parkeston, gantry cranes and over bridges at Parkeston, light industrial units south of Parkeston, with extensive hardstanding, and gantry cranes at Felixstowe.

7. The most significant features of Bathside Bay and in the surrounding study area that contribute to site character are:

- The open views across the river channel;
- The relatively contained character of the bay, which is deeply recessed and fringed by settlement on three boundaries;
- The intertidal mudflats and rough grassland of the reclaimed land;
- Views to the Port of Felixstowe;
- The low horizon of Harwich viewing east along the A120 rising to approximately 4m Above Ordnance Datum (AOD), surmounted by settlement;
- The perched settlement of Dovercourt lying up to 20m AOD and the associated tree cover of The Hangings;
- The linear and harsh character of the A120, without planting;
- The elevated section of the A120 at the Phoenix Bridge;

- Views to and the association of the western edges of the bay with Parkeston Quay;
- The flatness of the bay and its dynamic tidal character; and,
- The character of clear water and the visual link to the wider estuary and land rising to 25m AOD at Shotley Gate and in the mouth of the Orwell Estuary.

8. In addition, three Conservation Areas are present within the study area; at Harwich, Dovercourt and Mistley and Manningtree.

5.9 AIR QUALITY

1. A detailed air quality assessment has been undertaken by Posford Haskoning Ltd. for the proposed development of the Bathside Bay container port.

2. In respect of the Bathside Bay development, the principal pollutants considered in the assessment are nitrogen dioxide and PM10 particulate matter. These are the main traffic-related pollutants that are most likely to cause breaches of their respective air quality objectives. However, also included in the assessment are sulphur dioxide, carbon monoxide, benzene and PAHs. Lead and 1,3-butadiene are emitted from certain industrial processes and only in the vicinity of such installations are concentrations of these pollutants likely to be significant. Ozone is a 'secondary' pollutant, formed in the atmosphere by complex reactions, and is not released directly from road traffic or other industrial or transport sources.

3. Tendring District Council's own review of pollutants carried out under the Local Air Quality Management (LAQM) regime showed that all seven considered were predicted to comply with the relevant objective. The limited monitoring data available for the Harwich area supports this assessment for sulphur dioxide and benzene in that levels at selected monitoring locations appear to be within the objective values. Existing air quality in the district of Tendring can, therefore, be described as good. Although there are potential local sources of certain pollutants in Harwich, notably the port operations and the refinery, emissions from these operations were considered in the LAQM review process, which asserted 'generally good air quality'. This is as would be expected for a small coastal town and is consistent within the national context.

5.10 NOISE

1. Noise surveys have been carried out by BVAT in Harwich and Shotley Gate to obtain a measure of the existing ambient noise environment in the area potentially affected by the proposed container port. Daytime and night-time traffic noise measurements have also been undertaken at locations adjacent to the A120 which could be affected by an increased number of HGVs using this road, and measurements have been made of existing levels of railway noise in Manningtree and Lawford. Furthermore, noise measurements have been made on container ships and other vessels at the Port of Felixstowe and Harwich International Port, to determine noise emission values for the largest type of container ship likely to be using Bathside Bay, and to compare the noise of these with other ships in common use in Harwich Haven.

2. The surveys found that the ambient noise environment at Harwich and Shotley is variable, depending (in particular) on the wind direction and time of day. In addition, during the daytime the average background noise level is more constant than at night.

The presence of the Port of Felixstowe significantly influences the noise levels under certain meteorological conditions, but at other times the ambient noise environment is more affected by traffic noise and local activities.

5.11 VIBRATION

1. The effect of vibration on the local community is an important aspect of the construction and operational phases of the proposed development. The most significant potential sources of vibration are considered to be associated with the piling operations required for construction of the quay wall and the movement and stacking of containers during the operational phase.

2. In order to assess the potential impact of vibration, the existing vibration levels in the vicinity of Bathside Bay have been determined. Measurements of existing vibration were made at a number residential properties around Bathside Bay and at listed buildings in the vicinity.

3. The results of the background vibration levels indicated that the current levels of vibration are significantly below the threshold levels for causing cosmetic damage to residential or listed property.

5.12 COMMERCIAL AND RECREATIONAL NAVIGATION

1. Commercial navigation in the vicinity of Bathside Bay is dominated by the ferries travelling from Harwich International Port to Holland, Germany, Sweden and Denmark. Stena Line operates services to the Hook of Holland and Port of Rotterdam. Additionally there are regular passenger ferry services out of Harwich to Esbjerg and Hamburg, operated by DFDS Seaways.

2. Trinity House Lighthouse Service operates a number of buoy servicing vessels from its depot at Harwich and a historic navigation right exists to navigation within Gas House Creek to the east of Bathside Bay.

3. Recreational navigation is also popular within the Stour and Orwell estuaries, with a number of marinas being located in the Orwell Estuary.

4. The Harwich and Dovercourt Sailing Club uses a floating barge moored alongside the west side of Gas House Creek, in the north-east corner of Bathside Bay, as its clubhouse. There is also a boat storage yard, dinghy compound and lifting crane on about 2 acres of leased land on the seaward side of the seawall. The membership of the Club is understood to be around 140 people. The Club uses trot moorings for around 60 to 70 sailing yachts laid between April and October in the Stour Estuary to the west of Gas House Creek.

5.13 LAND-BASED RECREATION

1. Bathside Bay and the immediately surrounding area has been used for a number of informal recreational pursuits. However, the erection of the perimeter fence around those areas in private ownership has prevented access to the Bay. There are no public rights of way.

2. A range of other informal activities occur in the area such as birdwatching, angling and cycling.

5.14 ARCHAEOLOGY AND HERITAGE

1. The Sites and Monuments Record (SMR) (Essex County Council), historic Ordnance Survey (OS) maps, tithe maps, and other historical and archaeological literature were examined to ascertain the extent of known archaeological sites within Bathside Bay and its immediate environment. No sites were identified within the bay, though a number were located immediately adjacent to it, including a post-medieval Napoleonic Gun Battery and a number of World War II pillboxes.

2. In addition, the National Monuments Records Wrecks Index contains information relating to wrecks and ship losses within the coastal waters of England. The Index contained a number of records for sites within and adjacent to the bay, such as a steel swimhead barge (Thames lighter) that was stranded in 1953 and 2 ex-navy steam drifters that were run aground and abandoned in the 1940s; the bulk of these two vessel remains are believed to be the engine room and boilers.

5.14.1 Marine archaeology

1. There are extensive alluvial deposits within and adjacent to the bay, extending from 5m in depth in the main channel to over 20m in depth at the Mean High Water mark. The lower third of these deposits generally consists of sand and gravel. The layer of silt and clay alluvium above this presents an extensive record of accretion over the bay. However, there is little indication of terrestrial landforms and, therefore, any associated prehistoric terrestrial related activities. Activities that may have been undertaken in the bay are likely to have been associated with coastal resources (fishing, gaming, etc.) which generally leaves a paucity of evidence (in the form of sites) but has a very high potential for the preservation of organic remains. However, only one notable layer of peat has been identified at the far north-western end of the bay, which indicates that much of the bay has consisted of subtidal and low intertidal habitat over time.

2. The extensive silt deposits mean that there is the potential for any undiscovered maritime related features present to be preserved in situ. The sheltered and undisturbed nature of the bay and its proximity to Harwich and Dovercourt, with their associated historic development over the last 2 millennia (at least), present a wide period of use and, therefore, increase the likelihood of maritime finds. However, no evidence exists to indicate anything other than informal or infrequent use of the area.

5.14.2 Historic buildings

1. The north-eastern part of the site (the area proposed for the development of the Small Boat Harbour) is located within the ‘Harwich Conservation Area’ and incorporates the Train Ferry Gantry which is a Grade II listed building. It was entered on Essex County Council’s Buildings at Risk Register in 1995, with a priority E rating, indicating it is ‘under repair or in fair to good repair but no uses identified’.

2. There are two aspects to the listed Train Ferry Berth that make it of special interest as a structure:

- Historically, for the association of the bridge and gantry elements with the First World War. The whole of the structure was subsequently part of the first regular, cross-channel train ferry service; and,

- In engineering terms, the principal interest of the structure is in the design of the bridge element, which was jointed to enable racking (movement in two directions) and heeling. This design is not innovatory, however, rather a clever adaptation of existing materials (rivetted steel) and structural elements (trusses and pin joints) to a particular problem. No new structural problems were solved in its design. The approach bridge, walkway and berthing arms are of standard design, of little intrinsic interest.

3. No other historic buildings will be directly affected by the works.

5.15 LAND DRAINAGE AND FLOOD DEFENCE

1. There are four existing outfalls into Bathside Bay. The main outfall is from the Dovercourt Dock River ('Ramsey Creek') which discharges through a culvert that was constructed to carry the discharge through a previous reclamation. The second outfall is from the PDI building that is situated on reclaimed land to the east of the Bay. A third outfall drains a natural stream from Dovercourt and a fourth drains from the A120 Dovercourt bypass.

2. The existing flood defences in the area comprise a bund around the western end of the bay and the A120 also comprises part of the flood defence. These defences protect against a flood return period of 1:200 years (Environment Agency, *pers. comm.*). It is understood that the road forms a permanent hard flood defence. However, the section of defence between the road and Harwich International Port is considered a 'soft' structure.

5.16 TRAFFIC AND TRANSPORTATION

1. Harwich International Port (a centre for ro-ro freight, passengers and general cargo) has good road and rail links to London and the Midlands.

5.16.1 The local and trunk road network

1. The main road that would be affected by any increase in vehicle movements associated with the development is the A120. From the A12 to Hare Green, the road was built as a dual-carriageway as part of Colchester Bypass in 1982. The section of road east of Hare Green, however, is single carriageway, with short sections of dual-carriageway at a number of junctions. This road has been improved over the years, with single carriageway bypasses constructed, to accommodate traffic flows from Harwich and Wix.

2. According to the Highways Agency, the A120 carries up to 30,000 vehicles per day on the dual carriageway section and up to 12,000 vehicles per day on the single carriageway. A large proportion of these vehicles comprise heavy goods vehicles and other vehicles travelling to and from the port.

3. During a six-month period of the construction phase, the B1414 Clacton Road/Oakley Road and the B1352 Ramsey Road/Church Hill will also be used to access the site. This is in order to move topsoil to Bathside Bay from Hamford Water.

4. The B1414 is a single carriageway road and is generally lightly trafficked, although some HGVs currently use the route. The B1352, westbound from its junction with the B1414, is wider and has a dedicated cycle path. Heading east, the B1352 has a 7.5t weight restriction.

5. The main receptors in close proximity to the road network in Harwich include residential properties in the vicinity of Norway Crescent and Sweden Close, near the A120(T)/Parkeston Road roundabout.

6. Other sensitive receptors identified include residential properties at Wix Road in Ramsey, which are in close proximity to the Ramsey Bridge roundabout. A number of residential properties at Wix are also located in close proximity to the proposed topsoil route, including a school, located approximately 115m from the A120(T).

Proposed road improvements

7. The Highways Agency prepared a Route Management Strategy in June 2001 for both the A12(T) and A120(T). The strategy has proposed a number of high priority actions with respect to the A120(T), including:

- Improving the A12/A120 Crown Interchange westbound off-slip to Colchester;
- Signalising the A12/A120 Crown Interchange; and,
- Installing a roundabout at the A120(T) Hare Green/Harwich Road junction.

8. In addition, a programme of multi-modal studies has been undertaken by regional Government Offices to determine priorities for major transport investment. The most relevant of these to the proposed Bathside Bay development is the London to Ipswich Multi-modal Study (LOIS). The recommendations of the study include:

- Upgrading the A120(T) between Hare Green and Harwich to dual carriageway;
- Dualling the A120(T) between Braintree and the A12(T);
- Widening the A12(T) to six lanes between the M25 and A120(T) (Ardleigh junction); and,
- Further widening of the A12(T) north of the A120(T) (Colchester to the Copdock roundabout).

9. The Cambridge to Huntingdon Multi-modal Study (CHUMMS) is also relevant to Bathside Bay. Its recommendations relate principally to improvements on the A14, although rail freight improvements are also recommended.

5.16.2 The rail network

1. Rail movements into and out of Harwich are made via a branch line between Manningtree and Harwich Town. This line is double-tracked and is electrified. The line links into the Great Eastern Mainline (GEML) at a junction at Manningtree.

2. Harwich International Port was originally a railway port, with train ferries operating up until 1988. The rail share for freight was historically very high, reaching some 95% of all freight movements up to the mid-1980s. Container rail freight continued until 2000, when operations finally ceased. Freight trains continue to use the branch line into Harwich, although much of this traffic comes into and out of the yard at Parkeston Quay rather than being brought into the port by ship. Principal traffic flows include gas condensate and aggregates.

3. Passenger train services on the branch line between Harwich Town and Manningtree run via Dovercourt and Harwich International, generally at a frequency of one every hour in each direction during the day, weekdays and weekends. The majority of trains originate/terminate at Manningtree, with connections to Ipswich and to Liverpool Street Station, London, via Colchester and Chelmsford.

Proposed rail improvements

4. The UK container market is increasingly being dominated by 9'6" containers (currently the majority of containers are 8'6" in height). Only parts of the rail network can accept 9'6" containers on standard wagons, as greater height clearance is required – at present only the West Coast Mainline (WCML) is fully cleared. Furthermore, in places the network also has capacity constraints.

5. The stated policy of the Strategic Rail Authority (SRA) is to deliver an 80% growth in the use of rail freight by 2010/2011. The SRA's initiatives to achieve this include upgrading key routes to and from the UK's major ports, including the Harwich Haven Ports.

6. At present, work is taking place on the ground to enhance the gauge on the route from Harwich and Felixstowe to the WCML, via the ECML and North London Line (NLL), to 'W10' gauge (i.e. capable of taking 9'6" containers on standard wagons). This will enable the efficient movement of containers to and from the Haven Ports. Development work is also underway to eventually upgrade both the gauge and capacity of the cross-country route from these ports to the WCML, via Nuneaton (referred to as Felixstowe to Nuneaton, or F2N). This work is high on the list of the SRA's priorities.

5.16.3 Bus services and facilities for cyclists and pedestrians

1. There is a fairly comprehensive bus route system operating to or from Harwich. The routes originate/terminate from Clacton, Long Meadows, Colchester and Ramsey.

2. Harwich is also on the Sustrans cycle network. The current route links Wivenhoe to Colchester, and finally into Harwich. There are, at the time of writing, proposals to develop the network at various points along the route.

2. The existing cycle network in the vicinity of the development will be extended as part of the scheme to provide direct access for cyclists into the site. In addition, the 'Travel Plan' that is being developed for the scheme will include measures to further improve cycling facilities and to provide additional facilities for pedestrians.

5.17 INFRASTRUCTURE

1. Bathside Bay is located in a relatively developed area. The A120 road fringes the southern edge of the bay and the railway line from Harwich to Manningtree runs adjacent to the A120 road. Given the developed nature of the area, a range of utilities are present, including electricity lines, water mains, gas pipes and telephone lines.

2. However, as Bathside Bay itself is intertidal, it is unlikely that there will be any existing utilities within the bay itself, with the exception of the outfalls.

5.18 SOCIO-ECONOMIC CONTEXT

5.18.1 Sub-regional economic context

1. Bathside Bay lies within the East of England region. The economic performance of the region is quite varied, with a general tendency for economic indicators to deteriorate from north to east; with Bathside Bay located in the east of the region.

2. Essex sits within this regional context. Essex's GDP per head is less than £10,000 p.a. and is the lowest of all the East of England Counties. However, these figures are depressed by the fact that many people who live in Essex do not work within the county boundary and so do not contribute to the county's output.

3. Unemployment in Essex has fallen in recent years and was estimated at 4.3% in August 2002 (Claimant Count rate 2.2%). This is higher than the average for the East of England (4% on International Labour Organisation (ILO) measures). Around 11% of those unemployed are classed as long-term unemployed (unemployed for over a year), which is lower than the UK average.

4. In August 2002, the highest rates of unemployment were in Southend–on-Sea, Tendring, Thurrock, Harlow and Castle Point. Between 2000 and 2005, the levels of unemployment in Southend-on-Sea and Tendring are predicted to increase.

5.18.2 Local economic context

1. The Tendring Peninsula is a peripheral part of Essex. The peninsula has a mix of rural and seaside economies. On the coast is Clacton and its neighbouring resorts, and the port of Harwich with its links to mainland Europe. Harwich is a Priority Area for Economic Regeneration. Harwich's rural hinterland is also identified as a rural priority area for regeneration although this designation ceases to exist on 1 April 2003 as part of an East of England Development Agency (EEDA) review of urban and rural funding designations. These areas are all projected to fall further behind the regional average in terms of output and employment without a tailored intervention.

2. Of the working age population (approximately 71,800 or 53% of total population) in 1998 some 74% were estimated to be economically active. The workforce, therefore, is in the order of 56,000. Of this total, 31,200 were estimated to be in full and part time employment locally in 1998. More than a third of the workforce commutes outside the area to their place of work, with large numbers travelling to Colchester and London.

3. Within Tendring, the worst unemployment areas are to be found along its south-eastern perimeter. There is also significant unemployment at Walton and to a lesser extent around Harwich Port itself, although Harwich East is an unemployment blackspot.

4. Tendring is not a wealthy area. The proportion of full time employees earning below £250 per week is high, at 37%. This compares to a regional average of 25%. However, there is a high degree of out-commuting (some 40% of the working population), with workers bringing back spending power to the local area. Employment in Tendring is also expanding: employment increased by 8% between 1988 and 1998.

6 ASSESSMENT OF HYDRODYNAMIC AND SEDIMENTARY IMPLICATIONS: CHANGE AND MITIGATION

6.1 CHANGE IN WATER LEVELS

1. The proposed development will have a very small effect on water levels in the estuary system, in that the tidal range will slightly reduce (by 20 millimetres or less) and the level of low water will very slightly rise (by 11 millimetres or less). The impact is only of note because the small vertical changes correspond to greater horizontal movements of the shoreline and when the combined effect of these horizontal changes are 'added up' throughout the estuary system, they equate to a small but not insignificant decreased exposure of intertidal area (approximately 3ha).

6.2 CHANGES IN TIDAL CURRENTS

1. The main effect of the proposed development on tidal currents will be to cause a reduction in current speeds in the deepened waters of the Harwich International Port approaches. Tidal currents will reduce by up to 30% on ebb tides and by up to 25% on flood tides in these approaches. The area affected by this predicted reduction in speeds extends from the eastern end of HIP into the Felixstowe berths and approaches.

2. There are also some areas that are expected to experience increased current speeds, namely:

- On flood and ebb tides over The Guard;
- Slight increases on ebb tides at the berths of the Trinity Terminal;
- Slight increases on ebb tides at the eastern end of Erwarton Bay; and,
- Slight reduction in flows over Shotley Spit.

3. In themselves, changes to tidal currents are not problematic. However, changes in tidal speeds may contribute to changed patterns of deposition or erosion.

6.3 CHANGES IN WAVE ACTION

1. The Bathside Bay development is predicted to cause a generally small increase in wave activity in the lower Stour/Harbour area due to the reflection of waves that currently pass into, and are absorbed by, the bay (potentially increasing wave heights under large wind/wave conditions by 3 to 8%). The main influence of the development on wave action is expected to be local to the works, with the largest increases in height predicted along the new quay, where wave heights will increase by up to 23% during

large southerly and south easterly winds (together occurring for approximately 0.7% of the time). Corresponding increases due to winds from other sectors are of the order of a few percent.

2. Small increases in wave heights are also predicted over Shotley Spit and in Erwarton Bay. These increases in wave height are only associated with the largest waves produced by southerly winds (which only occur for around 30 hours every year).

6.4 SEDIMENT TRANSPORT AND DREDGING

1. The development is predicted to result in siltation in the new berths and approaches of between 1.0 to 1.4Mm^3/year. Furthermore, siltation at Felixstowe is predicted to increase from 2.8 to 3.3Mm^3/year to approximately 3.1 to 4.0Mm^3/year. The range arises from the assumption about the present rate of siltation at Felixstowe (taken to be between 8,000m^3/day and 9,000m^3/day).

2. If future maintenance dredging can be undertaken in a similar manner to that at present (i.e. dispersion of 28% of the dredged material back into the system) then the mass of material available annually for disposal offshore and/or the sediment replacement programme will be between about 1.6M and 2.1M dry tonnes.

6.5 EROSION OF INTERTIDAL AREAS

1. If the sediment replacement programme were to continue at its present rate of about 0.18M dry tonnes/year there would need to be an increase in the rate of disposal to the Inner Gabbard. This increase in the rate of removal of sediment from the estuary system would also have an impact on the rates of intertidal erosion in the estuary system. Without the proposed development, a proportion of the sediment settling in the deepened areas would have settled on intertidal areas further upstream. By causing this material, destined for intertidal areas, to deposit elsewhere and then by removing it offshore, these intertidal areas would be deprived of some sediment.

2. The net erosion rate on intertidal areas is a balance between deposition under calm conditions and erosion by waves during windy periods. By reducing the sediment supply to these intertidal areas the current rate of erosion (which is mostly natural) would be increased. The prediction is that without any measures to solve this problem in place, the current rate of erosion for the estuary system would be increased by 2.8ha a year. This would accelerate the underlying natural trend and further reduce the area available for birds to feed.

3. The impact of increasing the rate of erosion on the intertidal areas by taking material from the system (and disposing of it offshore) will be mitigated as part of the scheme by enhancing the HHA's ongoing sediment replacement programme. That is, the amount material placed offshore will be limited to the annual mass of material placed offshore prior to the 1993/94 channel deepening (i.e. 1.1M dry tonnes). Therefore, an additional impact will not arise.

6.6 ENHANCED LOCAL EROSION

6.6.1 Erwarton Bay

1. In addition to suffering erosion from an estuary-wide reduction in sediment supply, some areas of Erwarton Bay will be subjected to increased erosion (predicted to be 2mm/year) through a combination of localised increases in tidal currents and increased wave action under some wave conditions.

2. It is predicted that the resulting loss of habitat from Erwarton can be mitigated through the sediment replacement programme and targeted water column placements.

6.6.2 Shotley Point

1. Shotley Point is suffering from the highest ongoing rates of erosion within the estuary system, to the extent that some of the foreshore structures are likely to be damaged without any works taking place. The Bathside Bay development would slightly increase wave action and reduce current speeds over Shotley Spit. The combined effect would be to slightly increase the already high rates of erosion.

2. Given the high exposure of the spit, the sediment replacement programme proposed to offset losses of intertidal in the estuaries is unlikely to be able to mitigate the small increase in the rate of erosion over the spit. In addition, replacement at the level proposed will not alleviate the risk of damage that already exists.

3. Given the above, the HHA has proposed to place clay arising from the channel dredging along the upper shore to the west of the entrance to Shotley Marina in order to provide protection to the coast to offset the predicted effect of the proposed development. This clay placement would extend that to be undertaken using dredged material from the Trinity III Terminal (Phase 2) extension, which is underway.

7 POTENTIAL ENVIRONMENTAL IMPACTS

1. The key change associated with the works is the conversion of Bathside Bay from an intertidal habitat to a deepwater container port. Table A (Appendix 2) summarises the potential impacts associated with the proposed development for each relevant environmental parameter. In addition to identifying the potential impacts of the scheme, where appropriate, mitigation measures are set out and the extent of any residual impact is predicted.

7.1 DEFINITIONS

1. As far as possible, an attempt has been made to define the significance of each potential impact identified. The precise definition of impact significance across a number of agencies and individuals is difficult, although broad guidelines have been developed. There are a number of criteria that should be incorporated into the determination of the significance of environmental impacts. These criteria have been utilised here, where possible, to determine the significance of impacts identified during the environmental assessment process and are as follows:

- Magnitude of the impact (local/strategic);
- Spatial extent of the impact (small-large scale);
- Duration of the impact (short term/long term);
- Reversibility of the impact;
- Probability of the occurrence of the impact;
- Confidence in the impact prediction; and,
- The margins by which set values are exceeded (e.g. air or water quality standards).

2. In addition, in order to classify the significance of predicted impacts, and in an effort to provide a consistent framework for considering and evaluating impacts on different environmental parameters, the terminology presented in Table 2 has been adopted.

Table 2 Terminology for classifying and defining environmental mpacts

Impact	Definition
Negligible	The impact is not of concern
Minor adverse	The impact is undesirable but of limited concern
Moderate adverse	The impact gives rise to some concern but it is likely to be tolerable (depending on its scale and duration)
Major adverse	The impact gives rise to serious concern; it should be considered as unacceptable
Minor beneficial	The impact is of minor significance but has some environmental benefit
Moderate beneficial	The impact provides some gain to the environment
Major beneficial	The impact provides a significant positive gain

3. Where potentially significant adverse impacts have been identified, mitigating measures have been examined and recommended in order to reduce residual impacts, as far as possible, to environmentally acceptable levels.

7.2 EFFECTS OF THE PROPOSED DEVELOPMENT ON THE BIOLOGICAL RESOURCE

7.2.1 Benthic communities and ornithology

1. Table A (Appendix 2) shows that the proposed tidal works and channel dredging are predicted to have a number of impacts on the hydrodynamic and sedimentary regime of the Stour and Orwell estuaries. The deepening will have an immediate impact on the tidal propagation in the system resulting in a small increase in the height of low water, which will equate to a decrease in the exposure of approximately 3ha of intertidal area within the SPA on every spring tide. In addition, deepening the approach channel to HIP will result in sediment being trapped within it, increasing the rate of background erosion of the intertidal areas of the estuaries. Furthermore, the dredging of the channel to HIP is also predicted to increase the requirement for maintenance dredging at Felixstowe. In terms of the area of intertidal affected, this increased erosion equates to approximately 2.8ha annually. However, this predicted impact can be mitigated through expanding the ongoing programme of sediment replacement.

2. The main direct impact of the scheme is the reclamation of approximately 65ha of intertidal area (above CD) in Bathside Bay and the dredging of approximately 4ha of intertidal area in the Gas House Creek area. When combined with the predicted decrease in exposure of intertidal area in the SPA due to the effects of the proposed works on tidal propagation, the proposed tidal works will result in the loss/decreased exposure of approximately 72ha of intertidal area within the estuarine system.

3. The direct loss of intertidal area within Bathside Bay is considered to be of major adverse significance in relation to the benthic invertebrate resource. The benthic community present is considered to be comparable in terms of overall abundance and diversity with other intertidal areas throughout the system. The invertebrate communities present constitute an important feeding resource for a significant percentage of the estuarine waterfowl population. Given the location of the bay within the estuarine system, in particular its close proximity to the SPA and Ramsar site, these waterfowl populations form part of the SPA population. Therefore, it is considered that the bay forms an important contributory habitat to the waterfowl interest of the wider system. Given this, the loss of intertidal habitat within Bathside Bay is considered to be of major adverse significance for waterfowl. These impacts on the benthic invertebrate resource and ornithology are unavoidable.

4. A further indirect impact is predicted on the intertidal habitat and associated benthic community during the operational phase. This impact arises due to the trapping of sediment in the deepened channel, which is predicted to increase the rate of intertidal erosion throughout the estuarine system (2.8ha annually). Unmitigated, the enhanced erosion of this intertidal and associated communities is considered to be of major adverse significance. Furthermore, due to its designated status, an impact of major adverse significance on waterfowl is also predicted.

5. However, the indirect impact described above can be fully mitigated through the ongoing sediment recycling/replacement programme within the estuarine system.

6. Table A identifies a range of potential impacts associated with the proposed development on various other environmental parameters during the construction and operational phases. The majority of these impacts are of minor or moderate adverse significance, and many of them can be mitigated, reducing the significance of the residual impact.

7. Direct impacts on the subtidal benthic invertebrate resource due to the dredging works are considered to be, at worst, of moderate adverse significance. This impact arises in the currently undredged areas of the subtidal zone between the existing approach channel to HIP and the proposed quay face and in the area to the north of the existing channel. Within the existing approach channel the benthic community has already been impacted by dredging and, therefore, the impacts of the channel deepening here are considered to be of minor adverse significance.

7.2.2 Saltmarsh, coastal vegetation and invertebrates

1. The proposed works will cause the direct loss of 2.8ha of saltmarsh within Bathside Bay (accounted for above); this impact cannot be mitigated. In addition, unmitigated, the predicted effects of the tidal works on the rate of intertidal erosion would result in an increase in the rate of saltmarsh erosion throughout the system.

However, mitigation measures are proposed to address this predicted effect and, therefore, the post-mitigation impact on saltmarsh is expected to be negligible.

2. The works will also have a direct impact on the coastal vegetation and coastal invertebrate interest within Bathside Bay which is judged to be of moderate adverse significance. This impact cannot be mitigated. However, as an experimental measure (and in an attempt to maximise environmental benefit) it is proposed that the potential for the translocation of species is investigated.

7.2.3 Fisheries resource and commercial fishing

1. The construction phase will have an impact on the fisheries resource within the study area in the footprint of the channel dredging and tidal works due to the deterioration in quality, or loss, of feeding resource for estuarine fish. It is not possible to mitigate this impact, which is considered to be of moderate adverse significance. Further short term minor (to moderate) adverse impacts are predicted on the fisheries resource due to the elevation in suspended sediment concentration in the water column during dredging, which has the potential affect fish physiology and the larval and juvenile stages of fish species. Again, it is not possible to mitigate these impacts.

2. During the operational phase, there will be a minor impact on the fisheries resource as the maintenance dredging of the approach channel will prevent significant recovery of the benthic community and hence potential feeding resource for fisheries. The avoidance of sediment replacement during sensitive periods and in sensitive locations will avoid any impact on the fisheries resource, including the native oyster.

3. During both the construction and operational phases of the works, commercial fishing activity will be directly affected. This minor to moderate adverse impact arises due to the restriction in access to fishing grounds for safety reasons.

7.2.4 Water and sediment quality

1. A number of potential impacts on water and sediment quality could arise during the construction phase. However, most are expected to be of negligible significance, for example, reduced die-off of bacteria due to sediment plumes and the release of contaminants into the water column. No impact on bathing water is expected to arise. The generation of the plume itself is expected to be of minor adverse significance. No significant water quality impacts are predicted during the operational phase.

7.3 EFFECT OF THE PROPOSED DEVELOPMENT ON THE HUMAN AND BUILT ENVIRONMENT

7.3.1 Landscape and visual environment

1. As part of the EIA, a detailed assessment of the potential effects of the development of Bathside Bay on the landscape and visual environment was undertaken. Consequently, extensive consideration has been given to the design of the proposed development with the aim of minimising its landscape impact on the surrounding area. This approach - referred to as ‘mitigation by design’ - forms the basis of the scheme assessed in determining the potential effect of the proposed development on the

landscape and visual environment. Details of the mitigation strategy are provided in Section 3.1.5.

2. The landscape assessment included consideration of the effect of the development on settlements within the vicinity of Bathside Bay, the setting of Scheduled Ancient Monuments (SAMs) and listed buildings and on the surrounding landscape (as assessed from various viewpoints). The predicted significance of the effect on each of the above is summarised in Table 3. In general, effects on landscape character vary from minor to major depending on location of the view, with the intensification of the industrial character of the Felixstowe and Harwich headlands and harbour. The influence of increased skyglow will also vary from minor to major depending on the location of the receptor, with the effect reducing in distant views. The impact of the development will typically be more significant in local views towards the site from and across the water.

Table 3 Summary of the predicted effect of the proposed development on the landscape and visual environment of the study area

	Significance of effect[1]
Effects on urban settings	
Harwich	Major
Dovercourt	Moderate to major
Shotley	Moderate to major
Bathside	Moderate
Parkeston	Moderate to minor
Mistley and Manningtree	Minor to moderate
Effect on the setting of SAMs and listed buildings	
The Victoria Hotel, Dovercourt	Moderate
The Train Ferry Gantry, Harwich	Moderate
Properties on Church Street and West Street	Moderate
The former Great Eastern Hotel	Minor to moderate
Bathside Battery	Minor
Effect on surrounding landscape	
Felixstowe and Harwich Headlands and Harbours	Minor to major (subject to location)
Ramsey Creek	Moderate
Stour and Orwell Estuaries	Minor to major (subject to location)
Coastal Sandlings	Minor
Ramsey Creek and West	Moderate
Northwest and north Bathside Bay	Major
Felixstowe	Minor
Hamford Water and the Naze	Minor

3. In addition to the landscape effects described above, the visual impact of the proposed operational port has been assessed and the level of impact experienced from visual receptors within the visual envelope of the proposed scheme. Due to the scale of the proposals, the visual envelope is large and, therefore, the visual receptors are both distant and local and experience various degrees of visual impact.

[1] Where the effect in this context represents a change

4. The visual envelope extends across the estuary to the north onto the rising ground of the Suffolk Coast and Heaths Area of Outstanding Natural Beauty (AONB) to include Shotley and the mouth of the Orwell estuary. To the east, the Port of Felixstowe would experience views of the port and the port will be visible from Landguard Point.

5. Views from the south will reveal the settled peninsula surmounted by Dovercourt, with the upper portions of the ship to shore cranes apparent in views from Hamford Water and the Naze. To the west, views will extend along the A120 and Ramsey Creek corridor with glimpse views from high points.

6. Local views can be mitigated through screen mounding and planting which will deflect some views of the operational port. The elevated areas of Dovercourt will experience open views of the port; however, much of the settlement faces away from the bay thus limiting the visual impact to property.

7. The visual impact of the proposals are considered, in general, to be moderate in the local study area and moderate to major in the Urban and Conservation areas.

7.3.2 Air quality

1. The potential impact of the proposed development on air quality has been assessed using advanced atmospheric dispersion modelling techniques. A variety of pollutant emissions were considered, comprising those from shipping, land-based port related activities and additional traffic. Pollutant concentrations at sensitive receptors (e.g. residential areas) were predicted for scenarios in 2007, 2010 and 2022.

2. The assessment concluded that air quality objectives for benzene, carbon monoxide, nitrogen dioxide, particulate matter and sulphur dioxide will not be exceeded at any sensitive locations during the construction activities nor for future port operations.

3. Robust management of dust-raising activities will mitigate construction phase impacts and the development of a scheme Travel Plan is proposed for future port operations.

7.3.3 Noise and vibration

1. Sources of environmental noise and vibration from the proposed development have been identified and assessed. These fall into the following categories:

- Construction noise (e.g. from dredging, piling, reclamation and the pumping ashore of sand and gravel);
- Construction vibration (e.g. ground-borne vibration from piling);
- Operational noise and vibration (e.g. from container handling);
- Transportation noise (e.g. from an increase in the number of HGVs on the A120); and,
- Transportation vibration (e.g. vibration from container handling trains).

2. The main concern during the construction phase is noise generated by the piling works and investigations are ongoing to determine whether quieter methods of piling can be used. Vibration due to piling will similarly have an adverse effect in terms of

community perception locally (although no impact to structures will occur). Limited working periods are therefore proposed.

3. During the operational phase, mitigation measures include the use of noise reduction measures on plant and equipment for container handling. The installation of sensors on quayside cranes to minimise noise impact will also be trialed.

4. It is considered that, with the implementation of mitigation measures, construction noise will be of minor adverse significance generally, although noise from piling is predicted to be of moderate adverse significance for the duration of the works.

5. During the operational phase, the residual impact is predicted to be of moderate adverse significance for a number of properties in Harwich, Dovercourt and Shotley Gate and increased noise and vibration from increased rail activity is considered to be of minor adverse significance. Noise from increased HGV traffic on the A120 is also predicted to be of minor adverse significance.

7.3.4 Archaeology and heritage

1. The potential exists for a moderate adverse effect to occur on known and potential archaeological sites and landsurfaces during the construction phase. Geophysical and geotechnical surveys are being reviewed in order to assess the significance of this potential impact. If required, suitable mitigation measures would then be developed in consultation with English Heritage and the local authority archaeologist. The significance of the residual impact is therefore expected to be negligible.

2. The construction phase of the work will result in the demolition of part of the long berthing arm of the Train Ferry Berth. This demolition will be to a natural structural point and in line with the current extent of the short berthing arm. No other listed buildings will be directly affected by the works.

3. This partial demolition is needed to construct the small boat harbour. A dividing wall (breakwater) is necessary to protect the small boat harbour from the container vessel propellers and from the prevailing wave environment. Furthermore, in its present form the long berthing arm would intrude into the navigational path of container vessels approaching the proposed quay.

4. The element to be demolished is not of critical interest to the overall architectural and historic importance of the listed building. The remains of the structure are sufficient to indicate how the structure functioned, recording (as they do) the dimension of the train ferries' sterns.

5. The Train Ferry Berth is a significant feature of the Conservation Area, and figures in local views along the quayside. As such the berth also forms part of the setting of listed buildings in this area. However, the most prominent element of the listed Train Ferry Berth is the gantry, or lifting element; a vertical feature. The proposed demolition takes place to the side of this, in an area partly obscured by the structure already, and on the far side looking from the quay and the listed buildings. Its demolition will not, therefore, adversely effect the character or appearance of the Conservation Area. The setting of the listed buildings will be preserved.

6. It is predicted, therefore, that the potential impact on the special interest of the Train Ferry Berth is of negligible significance.

7. Nevertheless, as mitigation for the proposed works, a programme of repairs to the listed Train Ferry Berth and the remaining berthing arms will be undertaken. This will include a detailed appraisal to identify structural and other defects; the preparing and repainting of the structure to prevent corrosion; and the making good of the truncated berthing arm. HPUK will undertake works as required to ensure the satisfactory presentation of the listed building. In the long-term, HPUK intends to establish a suitable inspection and maintenance regime. The aim of these works will be to provide a secure future for an industrial structure which, by its nature, has no obvious use.

7.3.5 Commercial and recreational navigation

1. The lines of trot moorings belonging to the Harwich and Dovercourt Sailing Club lie within the area of the river to be deepened. As these moorings will be lost due to the works, proposals for the construction of a small boat harbour in Gas House Creek have been developed (and an application for planning permission has been made). The small boat harbour will accommodate the boats that are displaced due to the loss of the moorings and compensate for this impact.

2. Following mitigation, no significant impacts on commercial and recreational navigation in the estuarine system are predicted during the construction phase. During the operational phase, a small predicted increase in wave activity is expected to have a minor adverse impact on recreational navigation; the impact on commercial navigation is expected to be negligible. No other impacts on navigation are predicted.

7.3.6 Land-based recreation

1. There is no public access to the bay. Existing fencing will be maintained and, therefore, there would be no effect on land based recreational activity due to the works.

7.3.7 Land drainage and flood defence

1. The potential effect of the proposed development on the pattern of land drainage was investigated. The main outfall into the Bay is the Dovercourt Dock River. It is proposed that this outfall will be culverted beneath the tidal works and will eventually discharge, as before, into the Stour estuary through the new quay wall. Part of the flow from this outfall will be diverted to the wetland area developed as part of the landscaping works. The river is already pumped at this point, so diverting part of the flow will not have an adverse impact. Other smaller outfalls will be extended to the quay face or diverted to the wetland area.

2. Ultimately, the volume of water discharged, the composition of the water from the outfall and the receiving water will be unchanged from the existing situation. There will, therefore, be no impact on land drainage.

3. The proposed development will not have a direct impact on the existing flood defence structures to the west of the bay and making up the A120 along the southern edge of the bay. However, a new sheet piled floodwall will extend from Parkeston in the west to connect with the A120 defence bund, in turn connecting the to existing and

realigned bund at Gas House Creek. Critically, the design flood defence standard of 1:200 years will be unaffected and the existing standard of flood defence will be maintained at all times. It is also concluded that vibration during the construction works will not effect the flood defences.

4. The proposed development will have an effect on high water levels on mean spring tides but the predicted changes will be insignificant in terms of increased flood risk.

5. The predicted increase in wave heights has the potential to result in the increased incidence of overtopping of flood defences along part of the Harwich frontage. However, the change in wave direction will partly mitigate this effect. Overall, it is considered that the increase in wave height under certain wind conditions represents an impact of minor adverse significance.

6. The potential for the proposed development to result in siltation at outfalls and barrages in the lower estuarine system due to changes in the pattern of erosion/accretion and due to the sediment replacement programme was also investigated. No adverse impact is expected to arise.

7.3.8 Traffic and transportation

1. During the peak construction period (six-months), up to 204 HGVs a day will be generated, some 108 of which will be associated with the movement of topsoil from Hamford Water. At all other times the levels of HGV traffic will be lower than this, often considerably so.

2. The additional construction vehicles during the peak period will represent an increase of up to 3% on the A120(T), less than 5% on the B1414 and around 1% on the B1352. This volume of traffic will not have a material impact on the trunk road network. However, on the B1414 and B1352 the increase is made up entirely of HGVs on roads where lorry movements are relatively few. Other users may therefore experience a change in their perception of safety. A Traffic Management Plan will be prepared in conjunction with the as Highway Authority to reduce the impact of construction traffic on the road network

3. A detailed assessment of operational traffic impacts has been undertaken. Traffic generated by the development will add to baseline flows on the A120, with increases predicted to be in the order of 10% to 20% in the peak hour. With respect to this, the capacity of 12 junctions on the highway network to accommodate the increase was tested. This analysis predicted that capacity will be exceeded at the A120/Church Hill/Main Road “Ramsey Bridge” roundabout, the A120/Harwich Road junction roundabout, the A120/B1035 “Horsley Cross” roundabout and the A120/A1232/A12 intersection. In all other cases no impact will arise. Highway improvements, such as widening the running surface and single lane dueling, have therefore been proposed for the junctions listed. With these improvements in place, no residual impact will remain. A Travel Plan for the scheme, incorporating a cycle route, additional footways along the A120(T) and an employees bus service, has also been developed in conjunction with Essex County Council.

4. In addition, proposed capacity improvements on the cross-country rail routes out of the Haven Ports to the WCML will accommodate the trains predicted to be generated by the development of Bathside Bay (5 each-way trains a day in 2007 to 11 trains in 2017).

7.3.9 Infrastructure

1. Given that the proposed works will take place within the intertidal area, it is unlikely that there would be an impact on infrastructure. However, the Contractor should verify the location of any utilities in order to avoid any potential adverse impacts.

7.3.10 Socio-economics

1. During the construction phase, it is predicted that there will be a minor socio-economic benefit locally, regionally and nationally due to increased direct employment. Furthermore, indirect income and employment generation will result from expenditure on inputs to the construction process. Further income and employment will be generated in the local economy by the multiplier process; this occurs as recipients of the direct and indirect increases in local income have further positive effects on the economy by spending a proportion of their income on additional goods and services.

2. During the operational phase, the port will generate direct employment and also give rise to indirect economic benefits through multiplier effects and associated port activities, effects on the labour market and improved competitive advantage. The economic benefits range from minor to moderate significance.

8 COMPENSATORY MEASURES

8.1 INTRODUCTION

1. The environmental assessment demonstrated that the predicted impact of the tidal works within Bathside Bay on the intertidal mudflats and saltmarsh, benthic invertebrate communities, and the feeding and roosting habitats of wintering waterfowl populations cannot be mitigated. These features contribute towards the favourable condition of the Stour and Orwell Estuaries SPA and, therefore, it is concluded that the proposed tidal works are likely to have an adverse effect on the integrity of the SPA. In summary, this likely adverse effect arises due to:

- The loss of intertidal area (and hence feeding habitat for waterfowl) that contributes to the designated status of the SPA;
- The loss of roosting areas that support waterfowl during the high water period; and
- Through the above, the potential for the proposed development to increase pressure for resources (food, space, etc.) within the remainder of the system.

2. The predicted increase in the rate of erosion of intertidal areas (2.8ha annually) due to the proposed works can be mitigated.

8.2 HABITATS REGULATIONS

1. Assuming that the competent authorities concur with the above opinion, the provisions of Regulation 49(1) of the Conservation (Natural Habitats &c.) Regulations 1994 would apply and a case for overriding public interest (OPI) would have to be made. If it was concluded that the project must be carried out for reasons of OPI, the competent authorities may agree to the plan or project notwithstanding a negative assessment of the implications for the site. In such as case, compensatory measures are required to ensure that the overall coherence of Natura 2000 (the European Union's network of designated SPAs and Special Areas of Conservation (SACs)) is protected.

8.3 PARAMETERS TO BE CONSIDERED FOR COMPENSATORY HABITATS

1. There is no guidance on compensation either within the Habitats Directive or Habitats Regulations. However, based on experience of previous instances where compensation has been required, DEFRA has provided useful informal guidance regarding factors to be considered in developing compensatory measures. This guidance is summarised below.

8.3.1 Geographic location

1. When compensating for the loss of habitat due to development, the geographic location of the compensatory habitat is an important consideration. Generally, the compensation should be as close as possible to the affected site and, ideally, adjacent to it so that functionality can be maintained or links established.

2. In this case a local habitat would be considered to be one in the Stour and Orwell Estuaries SPA or Hamford Water SPA, and ideally in the mouth of the system to replicate conditions that do not freeze.

8.3.2 Type of habitat

1. Compensatory measures are intended to provide replacements for the key habitats and species affected by the proposals (i.e. those qualifying features for which the site is notified). Therefore, any compensatory habitats need to be of similar habitat type to those lost as a result of the works. For example, it is unlikely that the loss of intertidal mudflats could be properly compensated for by the creation of freshwater wetlands.

8.3.3 Sustainability of compensatory measures

1. Sustainability is vital for compensatory habitat creation. Any replacement habitat needs to have an assured life in excess of the habitat that will be lost and the design should seek to secure a sustainable option.

8.3.4 Timing and uncertainty in creation of compensatory habitats

1. Ideally, compensation should be in place before the loss of habitat due to development takes place. However, in cases where this is not possible, the compensation package should be scaled to take account of the additional impact. In addition, even in situations where the compensatory measures have been implemented

prior to development, there is likely to be some uncertainty in the confidence with which the habitat will be able to support the effected qualifying features. In order to address these uncertainties, the ratio of compensatory habitat to that which is lost may be increased; the magnitude of increase is subject to the level of uncertainty involved, time lag and spatial displacement.

8.4 PROPOSED COMPENSATION WITHIN HAMFORD WATER

1. In 2002, HPUK secured land on the northern shore of Hamford Water in order to provide compensation for the intertidal habitat that will be lost due to the proposed development of Bathside Bay. The compensatory site is a 138ha site located about 2.5km to the south of the mouth of the Stour and Orwell estuaries. It is proposed that intertidal habitat, consisting of mudflat, saltmarsh and sand and shingle, will be created through the managed realignment of the seawall.

2. Comprehensive hydrodynamic modelling and environmental studies have been carried out with regard to undertaking managed realignment at this site, and these will be reported in a separate Environmental Statement (accompanying a planning application for the works). The proposals for compensatory habitat are currently under development. However, in summary, it is predicted that approximately 98ha of mudflat, 10ha of saltmarsh and 4ha of sand and shingle habitat will be created within the site. The seawall will be reinstated to the rear of the site and backed by an area of terrestrial habitat (around 7ha) that will be enhanced. Furthermore, the brackish water soke dykes will be re-established behind the seawall.

9 MONITORING PROPOSALS

9.1 MONITORING DURING THE CONSTRUCTION PHASE

1. This section summarises the monitoring that is proposed during the construction phase of the proposed development in relation to the human and built environment. Monitoring of the natural environment is described in Sections 13.2 and 13.3.

2. Monitoring will be carried out at sensitive locations (e.g. flood defences, residential buildings or buildings of heritage significance) to determine whether vibration levels as a result of the works are likely to cause damage to such structures.

3. In addition, monitoring of construction noise levels will be undertaken.

4. Informal monitoring of the concrete pouring and filling works should be undertaken to allow early detection of any spills in order that remedial action can be promptly taken.

5. An archaeological watching brief should be maintained during the removal of silt and the dredging process to ensure that any unidentified features or finds are recorded.

6. A Travel Plan has been developed for the scheme and it is proposed that performance and targets will be reviewed on an annual basis, including into the operational phase.

7. Should measures be implemented to avoid the risk of gas accumulation due to effects on gas migration routes, monitoring would be required to determine the effectiveness of the measures that are put in place.

9.2 EXISTING MONITORING INITIATIVES

1. As part of the consent process for deepening of the approach channel to the Haven Ports in 1998/2000, the HHA developed a 'mitigation and monitoring package'.

2. In addition to the requirements for monitoring associated with the channel deepening, the HHA (in conjunction with the Port of Felixstowe) have adapted and extended the existing programme to provide the required monitoring information for the extension of the Trinity III Terminal. In line with this principle, it is proposed to further extend the ongoing monitoring programme in relation to the proposed tidal works and channel deepening at Bathside Bay.

3. To this end, the HHA will act as an agent to the Port of Felixstowe in implementing the actions of both parties with respect to the compensation, mitigation and monitoring arising from the works.

9.2.1 Objectives of the monitoring programme

1. The monitoring objectives can be summarised as:

- To increase understanding of the processes operating in the Stour and Orwell estuaries (and Hamford Water) and to define those aspects that relate to the proposed works;
- To measure the change in habitat distribution and to understand the relationship between morphology, habitat and the populations and distribution of designated bird species;
- To validate and refine the ongoing mitigation actions; and,
- To fully monitor the effect and thereby success of mitigation.

9.3 FUTURE MONITORING STRATEGY

9.3.1 Estuary-wide

1. Table 4 provides details of the HHA's existing monitoring programme and indicates (in ***bold italics***) those aspects that are relevant to the Bathside Bay development.

2. In addition to these measures, the following monitoring initiatives will be implemented:

- The continued detailed analysis of dredging performance, offshore placement and recycling through analysis and reporting of dredging records;
- Recording of dredging activities will continue with annual reporting of volumes of sedimentation (as measured by bathymetric survey), volumes dredged,

estimates of mass (dredged and in-situ) and volumes (masses) disturbed. The volumes (and estimates of mass) placed at Inner Gabbard or used in the sediment replacement programme will also be reported; and,
- Monitoring of dissolved oxygen concentrations throughout the water column during maintenance dredging and water column recharge.

9.3.2 Monitoring related to the proposed development

1. In addition to the estuary-wide monitoring recommended above, further targeted monitoring is proposed to measure the local effects of the proposed tidal works and channel deepening at Bathside Bay:

- 5 yearly topographic and vegetation (saltmarsh) surveys of Erwarton Bay and the Shotley foreshore;
- Targeted bed frame monitoring in the intertidal areas at the eastern end of Erwarton Bay and at Shotley to evaluate the benefit of water column recharge and to monitor the detail of intertidal processes;
- Monitoring of the clay placement at the Inner Gabbard (East) to identify the initial distribution of clay on the bed after placement and any subsequent movement; and,
- Monitoring of the biological communities at the Inner Gabbard (East).

9.3.3 Commitment to monitoring

1. A monitoring agreement will be developed for Bathside Bay through which the HHA and HPUK will make a commitment to the monitoring requirements described therein and discussed here.

Table 4 Overview of previous and ongoing monitoring by the HHA

Monitoring activity	Purpose	Action
Bathymetry	***To determine the changes in the intertidal and subtidal habitats in relation to erosion or accretion of sediment***	• ***Stour and Orwell estuaries and Hamford Water surveyed on a 5 year rolling programme (Stour and Orwell estuaries most recently completed in 2000; Hamford Water due to commence in winter 2002);*** • ***Surveys of the offshore area (channel and outer harbour) repeated on a 3 to 5 year return (most recently completed in 2001);*** • Surveys at the Inner Gabbard from 1998 to 2000 (characterisation for maintenance disposal); post-disposal surveys are also to be undertaken as part of the Trinity III Terminal (Phase 2) extension
Sedimentation and epifaunal recovery	To record potential sedimentation around the Roughs Tower following concerns raised by local fishermen	• Commercial lobster pots monitored for evidence of sediment accumulation (completed in 2000); • Forty modified prawn pots to monitor level of epifaunal recovery around the disposal ground (ongoing)
Sediment transport	***To define sediment transport pathways in and around Hamford Water***	• ***Ongoing research into sediment transport pathways offshore and in/out of Hamford Water;*** • ***Suspended sediment monitoring in the Harbour entrance***
Benthic communities	***To record any actual impacts resulting from the dredging operation, disposal activities and mitigation measures on the health of the biological communities and to determine any changes in community type that could occur as a result of the above***	• Monitoring of communities at the Inner Gabbard disposal site (post-disposal); post-disposal surveys are also to be undertaken as part of the Trinity III Terminal (Phase 2) extension • ***Biotope mapping in the Stour and Orwell Estuaries on a 5 year rolling programme. This aspect was most recently undertaken in 1997 and is due to be repeated in 2003***

Table 4 (continued)

Monitoring activity	Purpose	Actions
Fish, shrimp and plankton	***To record any changes in fish, shrimp and plankton population abundance and distribution that could result from impacts related to the sediment replacement mitigation measures***	• ***Monthly beam trawls (fish and shrimp) and zooplankton trawls at 12 stations throughout the estuarine system June 2000 to 2001; these surveys recommenced in December 2001 on a bi-monthly basis as part of the monitoring requirement for the Trinity III Terminal (Phase 2) extension.*** As part of the Bathside Bay development, it is proposed that these surveys would be undertaken during the dredging phase and for 1 year subsequent to completion of the dredging
Substrate depth	To assist in determining the influence of the deepening and sediment replacement initiatives on the 'health' of the intertidal resource	• A survey of sediment depths and distribution using a probe and gravity corer is underway and was completed in late 2001
Suspended sediment monitoring	***To meet the objective of providing sediment budgets that will enable refinement of mitigating/compensating measures, if required. To ensure that turbidity levels stay within acceptable limits following ongoing dredging and sediment reintroduction activities***	• ***Long-term silt monitoring has been undertaken in the Stour and Orwell estuaries using 6 silt monitors. Commencing Autumn 2001, one monitor was moved to outside the entrance of Harwich Harbour to record sediment movement towards Hamford Water. Another monitor is 'fixed' in the Stour and two others 'rove' in conjunction with sediment replacement. Two monitors were deployed in Hamford Water and its approaches in winter 2002;*** • ***Targeted intertidal bed frame measurements (undertaken in the Stour in 2001)***

Table 4 (continued)

Monitoring activity	Purpose	Actions
Intertidal vegetation and topography	***To meet the objective of defining the assemblage of intertidal habitats that provide for the effective geomorphological functioning of the estuaries and to fully monitor the effect and thereby success of mitigation***	• ***5 year rolling programme of topographic surveys (to provide information on the higher part of the intertidal profile, potentially using Environment Agency LIDAR data) and echo-sounding for the Stour and Orwell estuaries;*** • CASI flight and ground truthing undertaken for the Stour and Orwell estuaries and Hamford Water***;*** • ***5 year rolling programme for monitoring of seasonal vegetation***
Waterfowl distribution and abundance	***To observe trends in the distribution and numbers of waterfowl over the low water period throughout the estuarine system***	• ***Rolling programme of low water counts, completed for the winters of 1999/2000, 2000/2001, 2001/2002 and 2002/2003 (by SWT) and due to continue in the winter of 2003/2004 and onwards;*** • ***Annual analysis of high water count data for key species in the Stour and Orwell estuaries and Hamford Water against regional and national trends (involving the BTO)***