

CLIMATE CHANGE ADAPTATION REPORT



FELIXSTOWE DOCK AND RAILWAY COMPANY

AUGUST 2015



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1. EXECUTIVE SUMMARY

The Felixstowe Dock and Railway Company, trading as The Port of Felixstowe, is the Statutory Harbour Authority directed under the Climate Change Act 2008. The first climate change adaptation report was submitted in 2011. As part of the strategy for exercising the adaptation reporting power (2013) Government invited first round reporting organisations to provide progress updates.

This Report fulfils this requirement and also addresses climate change impacts on the commercial aspects of the business conducted by Hutchison Ports UK in the Port of Felixstowe.

Climate variability is already an issue for ports. With the future expected to bring higher sea levels and stormier conditions, milder, wetter, winters, hotter, drier, summers and more frequent heat waves, there is concern that climate change poses significant business, operational, health and safety, and reputational risks to the port.

The types of impacts we might expect from these climatic changes include increased risk of flooding and coastal erosion, pressure on drainage systems, possible winter storm damage, summer water shortages, increased thermal discomfort in buildings and equipment in summer, reduced demand for winter heating and increased demand for summer cooling.

Harwich Haven Authority provides marine navigational and conservancy services to the Port of Felixstowe. The Harwich Haven Authority Report, “Adapting to Climate Change” (2011) has been used as a guide to the climate change impacts on marine activity.

In order to fully understand the wider operational and commercial impacts, a risk assessment was conducted in collaboration with UK Climate Impacts Programme (UKCIP). The assessment has been reviewed against new evidence and changes implemented by the port for this report.

It is recognised that many interdependencies exist with other organisations which effect commercial operations – for instance, it is essential that local transport networks are maintained to allow the business of the port to continue.

The Hutchison Ports UK Environmental Committee oversees all aspects of climate change adaptation identified in this report and ensures that identified business risks are addressed at the appropriate level and time.

2. INTRODUCTION

The Climate Change Act 2008 requires that Harbour Authorities with a throughput of more than 10 million tonnes of commercial cargo annually prepare a report on the current and future predicted impacts of climate change on their organisation, and proposals for adapting to climate change.

2.1 PURPOSE OF THIS REPORT

To fulfil the Direction placed upon the Felixstowe Dock and Railway Company (FDRC) by detailing how FDRC has assessed the specific business risks, impacts and potential effects of climate change and adaptation affecting FDRC's statutory role and functions as a Harbour Authority. This second adaptation report considers the analysis in the first Climate Change Risk Assessment and the proposals developed through the National Adaptation Programme.

3. OVERVIEW OF STATUTORY FUNCTIONS

The main functions of a Statutory Harbour Authority (SHA), pertaining to FDRC may generally be classified as follows:

1. To provide and maintenance of harbour facilities, in particular the quays.
2. To regulate the activities of other persons at the harbour including, in particular, the movement and berthing of ships in the harbour, by means of directions and byelaws.
3. To undertake harbour operations including, in particular, cargo-handling activities.
4. To ensure the prevention of pollution and the conservation of nature.
5. To undertake navigational safety functions, including maintenance of lighting, the removal of wrecks and other obstructions.
6. To dredge navigational channels, (in conjunction with Harwich Haven Authority).

Additionally, as a Competent Harbour Authority (CHA), FDRC,

TO PROVIDE A PILOTAGE SERVICE - THE GENERAL DUTIES FOR THE PROVISION OF PILOTAGE SERVICES ARE CONTAINED IN SECTION 2 OF THE PILOTAGE ACT 1987. 3.1



INFORMATION ON ORGANISATION

In order to provide a more comprehensive report, factors such as interdependencies within the supply chain affecting FDRC's ability to function as a container port operator will also be explored.

This section briefly describes the functions, mission and objectives of FDRC and provides a brief contextual description of the Port of Felixstowe.

3.2 STATUTORY FUNCTIONS POTENTIALLY AFFECTED BY CLIMATE CHANGE

FDRC has various responsibilities placed upon it by its own Acts and Orders dating back to the foundation of the company through to The Felixstowe Railway and Pier Act 1875. As a Statutory Harbour Authority, FDRC also has a variety of other relevant duties and responsibilities under other general legislation. The Port Marine Safety Code provides a useful summary of the main "duties, powers and responsibilities" of a Harbour Authority.

When considering the primary Statutory duties and powers of FDRC as a Harbour Authority it is essential to recognise that many of the specific powers of direction required to control the movement of vessels are subject to approval of and/ or agreement of the Harwich Haven Authority (HHA) Harbour Master, and therefore climate change factors specifically associated with navigation safety must be read in conjunction with the "Adapting to Climate Change" report produced by Harwich Haven Authority.

3.3 THE PORT MARINE SAFETY CODE

The Port Marine Safety Code applies to every harbour authority with statutory powers and duties, including competent harbour authorities, which have specific powers and duties for marine pilotage. The Code applies to ports of all sizes, irrespective of resources, cargoes handled or levels of traffic.

The Code outlines the following duties:

3.3.1 OPEN PORT DUTY

This means that the harbour, dock, or pier must be open to anyone for the shipping and unshipping of goods and the embarking and landing of passengers, on payment of the rates and other conditions set by the local legislation for that port.

This is the main duty affecting FDRC and the Port of Felixstowe functioning as a container terminal operator; therefore, this report outlines the climate change adaptation considerations in relation to the provision of facilities provided for cargo handling.

3.3.2 CONSERVANCY DUTY

A harbour authority has a duty to conserve the harbour so that it is fit for use as a port, and a duty of reasonable care to see that the harbour is in a fit condition for a vessel to use it safely. Users should be provided with adequate information about conditions in the harbour. This duty covers several specific requirements:

- a) To survey as regularly as necessary and find the best navigable channels
- b) To place and maintain navigation marks in the optimum positions, which are suitable for all conditions
- c) To keep a 'vigilant watch' for any changes in the sea or river bed affecting the channel or channels and move or renew navigation marks as appropriate
- d) To keep proper hydrographic and hydrological records
- e) To ensure that hydrographic information is published in a timely manner
- f) To provide regular returns and other information about the authorities' local aids to navigation as the General Lighthouse Authority may require.

As previously mentioned all conservancy (hydrographic surveys and maintenance dredging to ensure safe depths for vessels as advertised on Admiralty Charts) duties are carried out by HHA, and therefore, reference to Harwich Haven's Climate Change Adaption Report is essential.

The FDRC Harbour Master (officially known as the Port Master) has a duty to regulate the movement of commercial shipping using the harbour. This is achieved, in conjunction with HHA, through Felixstowe Dock Tower providing a 24 hour radio reporting and information service to all shipping. A local Automatic Identification System (AIS) system provides domain awareness for navigation and security purposes.

Under the Merchant Shipping Act 1995, FDRC is responsible for the provision and maintenance of local aids to navigation, and regularly monitors and reports the performance and availability of the following aids:

Fixed Green Light at South End of Container Terminal (N01039)

Fixed Green Light at Ro-Ro Bridge No 4 (N01037)

Fixed Green Light at North End of Container Terminal (N10720)



Each light is placed above the main quay level and therefore is not considered a vulnerability due to climate change.

3.3.3 ENVIRONMENTAL DUTY

Harbour Authorities have a general duty to exercise their functions with regard to nature conservation and other related environmental considerations. They may now seek additional powers for these purposes. They also have an obligation, where a Special Protection Area for Birds or a Special Area of Conservation has been designated under the Wild Birds or Habitats Directives, to have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of those functions. Harbour Authorities also have to comply with The Natural Environment and Rural Communities Act 2006 which strengthens the requirement for public bodies, including statutory undertakers, to have regard for bio-diversity in undertaking their activities.

FDRC takes its environmental responsibilities extremely seriously, and has established an Environment Committee which looks at all aspects of the environmental impacts of its activities. The HPUK Environmental Policy Statement is at Appendix 1.



3.3.4 CIVIL CONTINGENCIES DUTY

The Civil Contingencies Act 2004 provides a framework for civil protection in the event of an emergency that threatens serious damage to human welfare, the environment or security. Harbour Authorities are classified as category 2 “cooperating bodies”. They will be involved in the associated planning work, and heavily involved in incidents that affect their sector. They are responsible for co-operating and sharing relevant information with category 1 (emergency services and local authorities) and other category 2 responders.

FDRC is fully committed to these duties, and through the Marine and Port Services Department operates its own Police Unit and Fire and Ambulance Services. These emergency services are available 24 hours per day and, as well as providing immediate on site response are available to the local community in support of local emergency services. Operations and training are aligned with the local authority services and therefore preparations for climate change are addressed in procedures and policies.

FDRC is responsible for the provision, maintenance and operation of oil spill response equipment and capability. In the Harwich Haven this is provided under a cooperation agreement known as the Haven Oil Working Group (HOWG) and FDRC is a major partner in this agreement providing trained manpower and specialised oil pollution prevention equipment.

4. AIMS AND OBJECTIVES POTENTIALLY AFFECTED BY CLIMATE CHANGE

This report considers aspects beyond the strict statutory role of FDRC, and therefore this section relates to the container port operator business of FDRC.

In this context it is the business of the Port of Felixstowe (POF), as part of Hutchison Ports UK Ltd (HPUK) which is under consideration. It is necessary

therefore to describe the activities of POF as a major UK port.

VISION

HPUK is to become the UK port developer, operator and logistics provider of first choice, delivering, to shippers and carriers, a service that is second to none

5. OVERVIEW OF THE PORT OF FELIXSTOWE - UK'S LARGEST CONTAINER PORT

The Port of Felixstowe is the UK's premier port – offering a comprehensive package of facilities to deep-sea, short-sea and feeder operators. It is a major hub for UK distribution and international transshipments for many of the world's shipping lines. As well as being the UK's largest container port, Felixstowe is a significant Roll-on/Roll-off port handling regular freight ferry services to Rotterdam.

Positioned on the South East coast of the UK, Felixstowe is ideally placed for vessels calling at any of the major European ports. The largest container vessels in the world can be handled with minimum deviation from the main global shipping routes. Every continent is served by deep-sea services calling at Felixstowe, and short-sea operators use the port to connect countries from Portugal through to Finland, Russia and the Baltic, and Africa through the Mediterranean to the Middle East and the Black Sea. An increasingly wide range of domestic coastal feeder services are also available. Approximately 35 shipping lines use the port, offering over 70 services and covering some 365 ports around the world, the opportunities for transshipping through Felixstowe are self-evident.

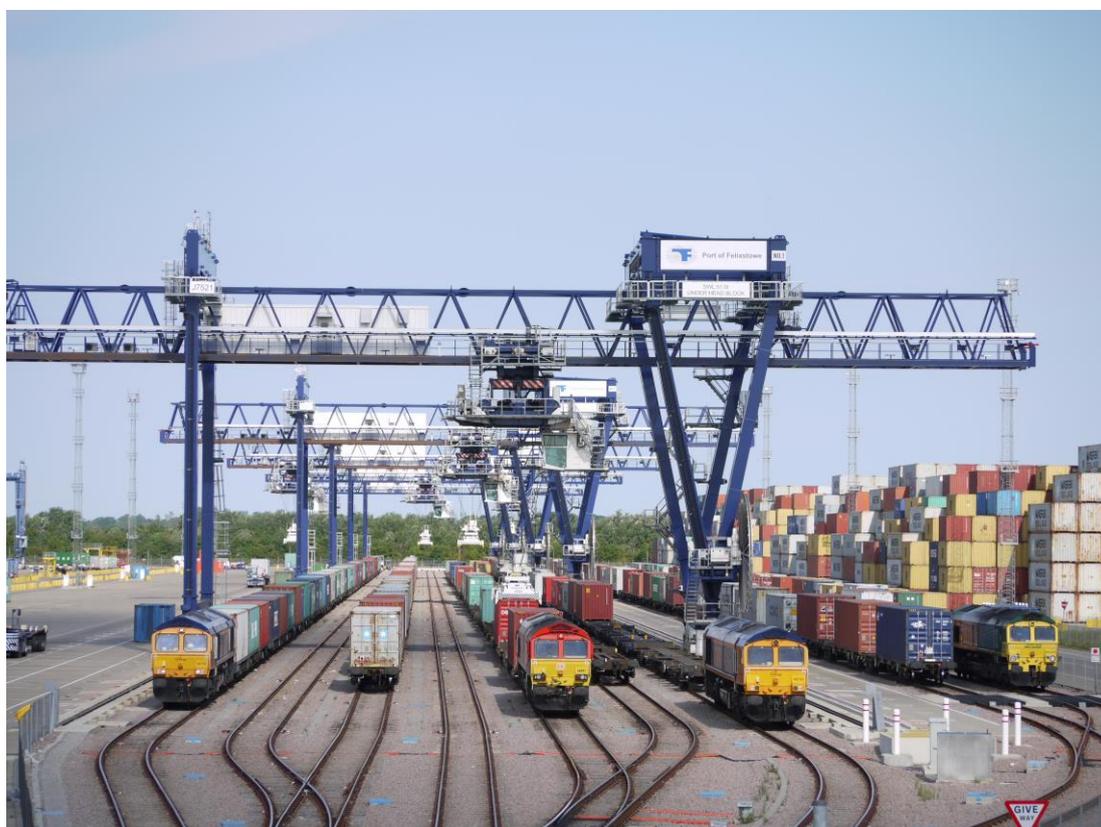
5.1 MARINE ACCESS

The main navigation channel and berths have depths that are maintained to ensure minimal tidal influence on the wide range of vessels calling at Felixstowe. With a navigation channel dredged to 14.5 metres below Chart Datum, and a depth of up to 16 metres alongside the quay, Felixstowe boasts deep-water able to accommodate the world's latest generation of deep-draughted vessels.

The Port of Felixstowe can provide customers with a continuous quay of over 2.3km, equipped with 23 ship-to-shore gantry cranes with a further 920m of quay and 10 ship-to-shore gantry cranes.

5.2 HINTERLAND CONNECTIONS

Inland, Felixstowe benefits from fast, modern roads to the industrial heartlands of the UK in the Midlands and the North, as well as to the population centres of London and the South East. Complementing this road system, the port has three rail terminals, with 62 incoming and outgoing trains per day to 16 UK destinations.



5.3 RAIL SERVICES

Rail operations are viewed as having a key role in the future at the Port of Felixstowe, creating critically needed, environmentally friendly logistical links to the core UK industrial hinterland markets.

The Port of Felixstowe owns and operates three intermodal rail terminals; the North, South and Central Rail Terminals. All rail terminals are multi-user facilities with open access to train operating companies. Combined capacity at these facilities comfortably exceeds 1,000,000 TEU (Twenty Foot Equivalent) per annum. The port owns and maintains approximately six miles of rail track, incorporating sidings, cross-port track and a Branch Line linking the North Terminal to neighbouring Trimley.

Container volumes transported by rail have increased significantly in recent years. Since 1997 Rail has increased its market share as a credible alternative to road haulage. Rail volume has grown by more than 7% per annum. Rail volumes currently represent approximately 26% of the port's UK domestic throughput, and continue to grow. Trains link Felixstowe with the major markets of the UK, providing direct connections to Glasgow, Manchester, Liverpool, Leeds, Teesport, Birmingham, Doncaster, Tilbury, Selby, Hams Hall, Daventry, Wakefield, Ditton (Widnes), Burton, Birch Coppice and Bristol..

5.4 FUTURE DEVELOPMENT

The most significant trend in container flows in recent years has been the surge in market share for the Far East trades and the growth in the size of container vessels. The Port of Felixstowe's Far East imports, notably from China, account for over 60% of all import container volumes, and this trend looks set to continue. In this sector, the consolidation of freight into ever-larger container vessels has been the most marked. Ships of 20,000 TEU are now a reality with the global order book showing orders for 62 new vessels of this size in the next five years.

5.5 SUSTAINABLE PROCUREMENT

The Port of Felixstowe wants to do business with people and organisations with shared values. All suppliers and contractors employed by the port are appraised on environmental, health and safety, and financial responsibility as part of the procurement process.

5.6 SUMMARY

The Port of Felixstowe is a dedicated container terminal which handles over 4 million TEUs (Twenty-foot Equivalent Units) a year. It operates 24 hours a day, seven days a week and is the UK's busiest container port and one of the largest in Europe.

Over 40% of the UK's import and export trade passes through the Port of Felixstowe, and its road and rail connections link it to the country's major markets, providing customers with a productive, consistent and quality service.

As such, the port plays a pivotal role in keeping UK trade moving and over 2,500 ships pass through its terminals each year – including the very largest container ships afloat today. Approximately 35 shipping lines operate from Felixstowe, offering over 90 services, and covering some 365 ports around the world. Importantly, the port provides some of the deepest water close to the open sea of any European port.

6. BUSINESS PREPAREDNESS

6.1 SITUATION FOLLOWING THE FIRST CLIMATE CHANGE ADAPTATION ASSESSMENT/REPORT

FDRC regards climate change as a business risk and includes both mitigation and adaptation measures in its normal business processes. The HPUK Environmental Committee is chaired by the Chief Executive and meets quarterly to review issues arising from environmental legislation, impacts and best practices.

It is accepted that the earth's climate is changing. It is predicted that this will bring increased temperatures, changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather, all of which can have some impact on FDRC's statutory functions and HPUK's operations. However, the impact of climate change will be relatively slow and appropriate adaptation or mitigation measures can be implemented within FDRC's existing strategic and corporate planning arrangements. These are reviewed as part of the organisation's forward business planning processes which look up to 5 years ahead in detail and more generally up to 10 years ahead on a rolling annual basis.

In order to assess the impact of climate change on its statutory functions and other operations, FDRC has taken into account the information available from many published sources, including the Inter-Governmental Panel on Climate Change Fifth Assessment Report (IPCC AR5), the UK Government Stern Report, the UK Climate Impacts Programme (UKCIP) including UKCP09 projections and the Climate Change Risk Assessment (CCRA) and National Adaptation Programme (NAP). Additionally, there were various predicted changes to the climate as set out in the document published by Defra: *'Adapting to Climate Change: Helping Key Sectors to adapt to Climate Change - Statutory Guidance to Reporting Authorities 2009.*

6.2 CLIMATE CHANGE RISKS IDENTIFIED IN INITIAL ASSESSMENT

The UK Climate Impacts Programme (UKCIP) identifies a range of possible future impacts. The most widely anticipated impacts which are likely to have an effect on FDRC's statutory functions and the wider business of HPUK are:

1. An increase in the risk of flooding and erosion, especially in respect of sea level rise
2. Significant changes in weather paths affecting cargo operations and transport
3. Greater pressure on drainage systems
4. Increased water demand
5. Increased summer cooling demands, especially buildings becoming uncomfortably hot
6. International supply chain effects on impacts and exports
7. Summer water shortages and low stream flows.

6.2.1 HPUK – UKCIP PROJECT

For the original climate change adaptation risk assessment HPUK worked with UKCIP to complete a high level climate risk assessment using the UKCIP Adaptation Wizard methodology.

Port Management recognises the need to identify the potential impacts of climate change on the port and is ready to take steps necessary to protect its strategic and operational objectives in the face of a changing climate.

Information has also been used from other publicly available sources including:

- The Environment Agency Flooding Risk Maps
- Local tide records
- Local knowledge and experience in relation to the areas of jurisdiction
- MCCIP Annual Report Card 2013
- UK Climate Change Risk Assessment: Government Report 201

6.2.2 “WHAT IS THE PROBLEM THAT NEEDS TO BE ADDRESSED?”

The original risk assessment informed that climate change could exacerbate weather-related risks, but was unlikely to present new risks not previously encountered. As a result the following examples of climate change impacts that could be experienced have been identified:

- 1) Power outages caused by damage to the distribution network
- 2) Changes to sedimentation patterns which could in turn affect navigation routes within the port and require alterations to maintenance and dredging regimes
- 3) Weather-related disruption to inland distribution networks that could result in knock-on effects within the port
- 4) Adverse weather negatively impacting on service provision losses and stoppages.

It was recognised that should climate risks increase in future and adequate steps not taken to address them, more frequent port closures could result, adversely affecting the port’s reputation. However, if early steps are taken to assess and address climate risks, the port could benefit by keeping one step ahead of its competitors.

6.2.3 ASSESSING RISKS

The risk assessment process accepted that the climate change predicted in the various sources should be considered. It was not necessary to dwell on the scale of each impact, as the timescale of climate change was much longer than many of the business decisions made in the normal course of events. In summary, **climate change is expected to mean** hotter, drier summers; milder, wetter winters; rising sea levels; more frequent heat waves, heavy downpours of rain and increased storminess; and less frequent cold snaps.

As climate change predictions improve, or indeed, actual changes occur, the greater understanding of adaptation measures will influence decision making for example, in procurement decisions. The risk assessment considered three timescales:

- The current climate e.g. for decisions relating to contracts/ office management
- The 2030s climate e.g. for decisions relating to new equipment technologies
- The 2060s climate e.g. for decisions relating to new infrastructure developments.

In order to classify each risk, a simple 1-5 rating system was adopted, as detailed below. This assesses the risk of both the likelihood of an impact occurring and the magnitude of the consequences should the impact occur:

Risk = **likelihood** of an impact occurring x **magnitude** of the consequences if it occurs

Likelihood	Magnitude	Consequence
1 = Negligible	1 = insignificant	20 - 25 = Very High
2 = Rare	2 = minor	15 - 20 = High
3 = Unlikely	3 = moderate	10 - 15 = Medium
4 = Possible	4 = significant	5 - 10 = Low
5 = Probable	5 = catastrophic	0 - 5 = Inconsequential

The results of the risk assessment are shown in Table 1.

6.2.4 KEY THRESHOLDS

In order to assess the magnitude of risk, three key thresholds were identified during the risk assessment exercise:

1. Wind speeds can be critical to maintain a safe environment for container operations
2. A one day work stoppage in the port would be critical for customers with just-in-time deliveries
3. A three day closure to the port would be critical for most customers, and everyone upstream and downstream of the port would suffer.

6.2.5 RISK ASSESSMENT COMMENTS

The risk assessment takes into account several key indirect impacts on global trade, but assumes that a similar level of trade continues. These impacts include:

- Changing demands and markets for imported goods
- Changes to the availability of energy for shipping possibly leading to a worldwide reduction in shipping
- Changes to the supply chain logistics

6.2.6 PRIORITY CLIMATE RISKS IDENTIFIED IN THE FIRST ASSESSMENT

The following priority climate risks that require an adaptation response were identified:

- Power supplies - including high voltage lines – may be disrupted owing to off-site disruption to the network as a result of increased frequency of high winds or other extreme weather
- Increased risk of flooding could put on-site power supplies at risk
- Increased frequency of extreme weather events could increase the frequency of crane and pilot stoppages
- A port closure of more than 3 days, caused by high tides, winds, heavy downpours of rain or heavy snow

- Combined sea level rise and storm surge may increase the risk of quays being overtopped, which would cause high voltage power supplies to cranes to be shut off, resulting in work stoppage
- Consistently higher sea levels would reduce clearance between ships and booms affecting the loading and unloading of cargo.

7. REVIEW OF THE FIRST ASSESSMENT OF RISKS FROM CLIMATE CHANGE TO THE ORGANISATION, AND ITS FUNCTIONS

This section addresses the review of the original risk assessment undertaken as part of this second round of reporting. The review is informed by changes to predictions on climate change impacts and actions taken to mitigate risk since the first assessment.

7.1 LATEST CLIMATE CHANGE ADAPTATION INFORMATION

CLIMATE CHANGE RISK ASSESSMENT (CCRA) - THE NATIONAL ADAPTATION PROGRAMME (NAP)

This is pertinent to the Port of Felixstowe climate change adaptation risk assessment in that it “describes which risks highlighted by the CCRA and in subsequent consultation with Defra partners require urgent attention”.

“The climate-related risks faced by businesses include flooding (direct damage to assets and indirect damage via supply chain disruption), threats to water availability and overheating of premises. 88 other priority risks from the CCRA are summarised in the table (Table 1) below.”

CCRA Risk	Description
FL7a/b	Non-residential (business) properties at significant risk of flooding, and linked to Expected Annual Damage (EAD) to non-residential (business) property due to flooding
WA3/WA5	Reduction in water available for public supply and public water supply-demand deficits
EN2	Energy demand for cooling
BU7	Insurance industry exposure to UK flood risks means that mortgage provision threatened due to increased flood risk

Table 1

These areas were considered in the risk assessment review as summarised in table 3, page 23.

7.2 INTERDEPENDENCIES

The nature of the port is that it is a significant node in intermodal supply chains. This is a significant advantage for low carbon supply chains in the UK. It does however create risk to the business from third parties over which the port has limited influence. Two key interdependencies include transport and energy. The transport sectors most at risk from climate change are rail and highways.

7.3 TRANSPORT

7.3.1 ROAD

This report is informed by the Highways Agency Climate Change Risk Assessment of August 2011

The Highways Agency risk assessment states its desired outcomes to be:

- Climate change considerations are factored into Highways Agency investment controls and business as usual, including design, construction, maintenance, and operations
- Early consideration of climate change risks will lead to greatly reduced costs over asset life
- A move away from reliance on historical weather record as basis for standards and specifications
- Residual climate change risks are assigned appropriate management action
- The Highways Agency can demonstrate an effective approach to climate change risk management to fulfil the port's reporting obligations.

The Prioritisation of risk as an outcome of the Highways Agency risk assessment is summarised in Figure1 below.

Priorities for Adaptation

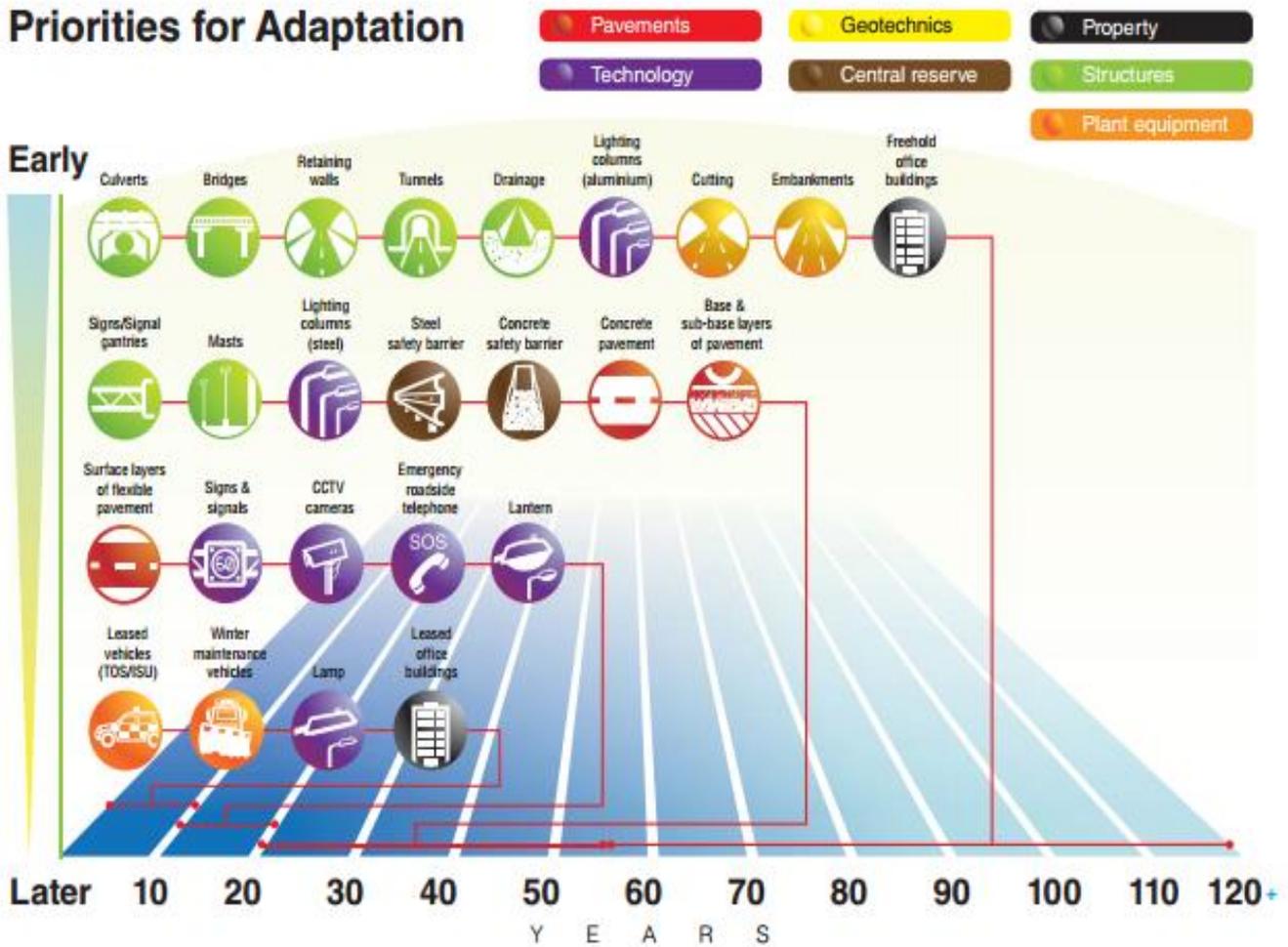


FIGURE 1

7.3.2 RAIL

The main information source informing this report is the Work Package 1 (WP1) of the Tomorrow's Railway and Climate Change Adaptation project (TRaCCA) published by the Rail Safety and Standards Board (RSSB).

MAIN QUANTIFIABLE IMPACTS HIGHLIGHTED IN THE REPORT

HIGH TEMPERATURES ACROSS SUB SYSTEMS

Rail buckling and/or associated misalignment problems.

The magnitude of the projected increases varied across the UK and ranged between a three-fold and ten-fold increase under the medium emissions scenario in 2080.

Excessive overhead line (OHL) sag for tethered systems.

Currently these incur on average, 550 delay minutes per year, however, the future impact is not clear as the tethered systems are older designs that are reaching the end of design life. Although the locomotives currently using the port are diesel, any disruption to the network could have an impact on freight train arrivals/departures at the port. Low temperatures across subsystems

Blockage by snow of points or freezing of points and ice formation on third rail causing contact failure.

The impact of this was estimated to reduce by the 2080s due to projected climate change.

Impacts of cold weather.

An upper bound estimate was found of £20m for the installation of third rail heating and £2.7m per year in operational costs for key sites across the south east region.

Increased risk of slips, trips and falls for workers due to ice.

Slips, trips and falls account for 46.8% of the safety risk to passengers, this is also the largest risk to the workforce (Safety Risk Model: Risk Profile Report, version 7.5, Rail Safety and Standards Board, 2012). How this will be impacted by increasing temperatures is not clear.

Reduced effectiveness of brakes due to snow and ice accretion (freight trains more susceptible).

This was found to be a factor in two accidents.

HIGH PRECIPITATION ACROSS SUB SYSTEMS

Earthworks failure and landslides.

It is not clear how the changing rainfall patterns would interact with what is currently a reducing trend.

Increased risk of slips, trips and falls for passengers and workers in all areas due to wet ground.

How this will be impacted by changes in rainfall is not clear.

Increased risk of floods.

During June and July 2007 flooding costs to the GB railway were estimated at £10.5m in material damage and £25.6m in business interruption. During the same period, 265 Network Rail sites were affected by flooding. Of these sites 107 experienced performance delays only, with the remaining 47 experiencing significant damage (Flood resilience and resistance for critical infrastructure (C688) Construction Industry Research and Information Association, CIRIA 2010).

The most likely and potentially significant impacts of climate change as determined by the TRaCCA project are summarised in table 2 below.

Nature of climate change	Possible impacts
High temperatures	Rail buckling; excessive overhead powerline sag; passenger and worker discomfort
Low temperatures	Damage; disruption; slips, trips and falls; reduced brake effectiveness from snow and ice falls
High precipitation events	Earthworks failure and landslides; slips, trips and falls; bridge scour; floods
High sea levels and storm surge	Coastal erosion; damage to sea walls; earthwork failure)
High winds	Damage to equipment (for example overhead power line) and lineside fires

Table 2

7.4 PORT RAIL OPERATIONS

The port has implemented new, safe methods of work to allow freight trains to be serviced in wind conditions which would have previously interrupted the operation and creating disruption to the rail supply chain. This method utilises alternative equipment capable of working safely at higher wind speeds giving rail operations increased resilience. These methods, as with all port operations are being continually reviewed to realise opportunities to further improve resilience.

7.5 ENERGY

Energy – “Over the coming decades, the UK’s energy system faces a number of challenges including the need to decarbonise, the fact that around a fifth of our 2011 generating capacity has to close over this decade and declining domestic fossil fuel production in the context of rising energy demand” (DECC Annual Energy Statement Nov 2012). Capacity has been further exacerbated by the significant loss of capacity generation in 2014. The Port of Felixstowe has its own decarbonisation and air quality improvement programmes.

Over the next five years the port plans to convert approximately 50 % of its Rubber-Tyred Gantry Cranes (RTGC), currently diesel/electric, to fully electrical RTGCs. While this will reduce carbon emissions and further improve local air quality, there will be an increase in electricity demand.

With this in mind as part of its ISO 50001 certified Energy Management System, the port has implemented a series of energy efficiency and renewable generation installations, which will help to mitigate the increased electricity demand. In addition, the RTGCs will retain their on-board diesel/electric generation capability, allowing them to revert to traditional operation if there is a loss of supply. This gives the port resilience in its operation should any of the risks around energy capacity highlighted in the Climate Change Risk Assessment and NAP become critical to the ports operation while mitigating future climate change.

In addition, since the first adaptation assessment the port has installed around 3000 LED and other low energy lights. This has reduced the demand, particularly at times of high demand (winter afternoons/evenings) by around 600kW, 8%.

The National Adaptation Programme highlights increased demand for cooling as a “*priority risk*” (Risk EN2, Defra July 2013). Adding to the investments mentioned above, the port has installed 10 photovoltaic arrays with a total installed capacity of over 520kWp;

reducing demand from the National Grid during periods when demand for cooling is at its greatest. For example, the port building with the highest demand for cooling is the Temperature Controlled Examination Facility (TCEF). The TCEF has the port's largest solar array (152kWp) installed. This not only meets the cooling demand for this building at peak times (middle of the day in summer) but as with several other arrays now installed, actually exports electricity to areas of the port which may also be experiencing increased demand from cooling equipment.

The TCEF is an important facility for the operation of the port. The examinations undertaken in the TCEF are usually of products of animal origin, and are predominantly called for by the Port Health Authority.



7.6 CLIMATE CHANGE ADAPTATION RISK ASSESMENT FOLLOWING REVIEW

TABLE 3 – 2015 CLIMATE CHANGE ADAPTATION RISK ASSESMENT FOLLOWING REVIEW

Climate variable	Impact	Consequence of impact	Likelihood	Magnitude	Risk	Assumptions and reasoning behind risk ratings	Adaptation assumed in risk assessment	Notes	Change in Risk since previous report.	
			Current							
			2030's							
			2060's							
1	Increased frequency of high winds or other extreme weather, including lightning strikes	Power supplies disrupted owing to off-site disruption to the network.	All work would stop. Loss of business reputation. Lightning strikes can cause temporary dips in power causing failure of quay crane equipment.	2	4	8	Above ground external power supplies, therefore susceptible to wind damage. Loss of power is usually partial or short term.	Autonomous adaptation (changing practise) by others resulting in more of the network of importance to the port being installed underground. The port is installing equipment capable of monitoring lightning strikes which may impact on power supply continuity. This will allow the port to react, thus limiting down time/damage to equipment.	The greatest risk to on-site power supplies is off-site disruption. However, this has never been a total loss or for an extended period. Essential services only will be maintained by stand-by generator. More on site energy is being produced by renewables and consideration is being given to future back up sources.	Reduced
				1	4	4				
				1	4	4				
2	Increased frequency of high winds or other extreme weather	Ships break loose from moorings.	Damage to ship, quay and cranes; disruption costs; insurance premiums rise.	1	2	2	Very low likelihood and therefore risk, assuming good practice is maintained.	Could be averted through good practice.		No change
				1	2	2				
				1	2	2				



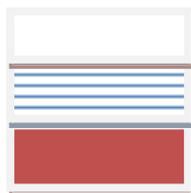
3	Increased frequency of high winds or other extreme weather	Office water supplies are cut off.	Health and safety is compromised and offices are shut, disrupting work.	1	1	1	This risk varies across site but on the whole is rated low because it is assumed water could be tanked in, and portaloos erected.	Assumed emergency response is adequate and that water and loos are available in the event of a crisis.	Tomline House more at risk than other buildings.	No change
				1	1	1				
				1	1	1				
4	Increased frequency of extreme weather events	Operational disruption – pilotage, cranes.	Work stoppages. Reputation damage. Health and safety concerns, operational and cost implications.	4	3	12	Stops work and carries a high reputational risk. More automation will put fewer workers at risk; more robust machinery would improve worker safety. Quick recovery from stoppages reduces reputational risk.	Autonomous adaptation (developments, such as fully automated cranes) assumed. The life expectancy of this equipment is shorter than the climate change timescales allowing manufacturers to adapt.	Safety procedures revised to improve working conditions and site safety. Some of these have allowed areas to continue working when previously they would have stopped. Work continues to review procedures to mitigate impact to operations. Recovery procedures in place. Equipment is already in use in locations with extreme weather conditions – heat, cold, wind.	
				5	2	10				
				5	2	10				
5	Increased frequency of extreme events	Staff unable to get on-site.	Operations adversely affected by absence of staff.	2	2	4	These incidents might be caused by a traffic incident, snow, flooding.		Magnitude reduced as some staff will attend and disruption of this sort is assumed to be short-lived.	No Change
				3	2	6				
				3	2	6				

6	Increased frequency of extreme events	Insurance premiums rise as number of claims increase.	Increased operating costs.	1	1	1	Insurance premiums are a small percentage of overall operating costs.		The port is exploring insurance derivatives to hedge their exposure to losses due to exceptional events.	No Change
				1	1	1				
				1	1	1				
7	High winds	Containers blowing over; damage to buildings, telecommunication towers etc.	Works required to right containers and rectify any damage. Increased maintenance costs and disruption to work.	1	1	1	This is an operational problem rather than a key business risk.	The risk to operations to decrease in future, because equipment will become more robust and operations increasingly mechanised.	Container stacking strategies limit risk of containers blowing over. PoF collaborates with manufacturers to develop more robust designs.	
				2	1	2				
				2	1	2				
8	Increased winter precipitation	Drainage ditches overtop.	External Flooding Damaged goods, disruption and clean-up costs.	3	2	6	Dry goods are most at-risk of flood damage.	Containers in areas at risk of flooding now placed on concrete plinths.	Maintenance of drainage ditches increased to improve drainage. Improvements to drainage are likely with planned developments.	Reduced
				4	2	8				
				4	2	8				
9	Increased winter precipitation	Downpipes overwhelmed, flooding vital equipment.	Internal Flooding Operational impact Loss of income, Reputation damage.	5	1	5	Communications rooms main risk. Regular maintenance will limit likelihood.	Planned adaptation of buildings to increased winter precipitation is assumed.	Drainage system has been replaced by external pipes with a greater capacity.	No Change
				5	1	5				
				5	1	5				
10	Increased winter precipitation	Regional road and rail network disrupted by flooding.	Traffic problems; on-site logistics are disrupted Operational impacts.	1	4	4	Interdependencies on regional infrastructure providers.	Assumes regional road and rail infrastructure remains viable. The port's modal split and distribution options reduce reliance on any single route.	Contingency plans exist to deal with these events. Improvements to rail infrastructure continues.	Reduced
				1	4	4				
				1	4	4				

11	Heavy precipitation	Flooding Electrical Sub stations.	Disruption and clean-up costs; damage to property. Insurance premiums rise.	1	3	3	Flooding of the sub-station would cause severe operational problems.	Procedures in place to monitor weather conditions. Any substation at risk would be isolated to reduce any time off line.	Flood Plan modified to deal with fluvial flooding as well as estuarial flooding. New developments are being designed with greater flood protection.	No Change
				2	4	8				
				3	4	15				
12	High tides, winds, heavy downpours of rain, heavy snow	Extended Port closure.	Port operations critically affected, supply chain critically affected Insurance.	2	5	10	Impact on UK distribution of goods. Stocks running low in high street stores.	Assumes regional road and rail infrastructure remains viable.	Just in time supply chain effects on industry must also be considered.	No Change
				2	5	10				
				3	5	15				
13	Hotter summers	Offices and warehouses overheat, causing excessive temperatures for outdoor working and in vehicles.	Staff comfort and productivity decline.	1	1	1	Most offices and operator cabs have air con which can maintain indoor temperatures at 10degC below ambient temperatures.	Better insulation would enhance building performance, but retrofitting is expensive. Vehicles adapted for hot climates.	Experience from ports in other parts of world (hotter climates) available. Buildings are being fitted with improved insulation when refurbished.	No Change
				1	1	1				
				2	1	2				
14	Hotter summers	Refrigerated containers. Greater demand Greater risk in event of failure.	Increased demand for power.	1	1	1	Interdependency with demand for more refrigerated goods likely to be driven by demand.		Increased power requirements would increase vulnerability to port-wide power failure. Over 500kWp of PV generation has been installed to generate electricity during hotter sunnier periods. Renewable on site generation installation continues.	Reduced
				1	1	1				
				1	1	1				

15	Hotter summers	Tarmac melts	Activity in affected area disrupted, unplanned maintenance costs	1	1	1	Although likelihood of tarmelt must increase with higher temperatures, the magnitude of consequence is assumed to diminish	Tarmac is being replaced by more heat resilient surfaces.	Most hard surfaces covered by material that is more heat resistant than tarmac.	No Change
				1	1	1				
				1	1	1				
16	Sea level rise (SLR) and storm surge	Flooding, quay is overtopped, causing high voltage power supplies to cranes to be shut off.	Disruption and unplanned maintenance costs. Damage to reputation.	1	5	5	Similar to land based flooding.	New quay designs will follow best practice and legislated standards.	New quay designed with climate change in mind and is unaffected by SLR.	No Change
				2	5	10				
				3	5	15				
17	Sea level rise and storm surge	Consistently higher sea levels would reduce clearance between ships and booms.	Greater threat of damage to ships and cranes. Work stoppages. Insurance premiums rise.	4	1	4	Vessels are getting larger to achieve economies of scale; therefore shore infrastructure adapts to keep pace. This lifecycle is shorter than climate change period.	Crane sized to match vessels.	Cranes already operate in areas with more frequent extreme climate variables.	No Change
				5	2	10				
				5	2	10				

Key: Timescales



The current climate e.g. for decisions relating to contracts/ office management.

The 2030s climate e.g. for decisions relating to new equipment technologies;

The 2060s climate e.g. for decisions relating to new infrastructure developments.

8. UNCERTAINTIES AND ASSUMPTIONS

8.1 UNCERTAINTIES IN THE ADAPTATION PROGRAMME

FDRC's adaptation plans are based on the evidence provided by UK Climate Projections 2009 (UKCP09) and this information covers three scenarios for future climate change projections.

The following limitations have been identified from information within UKCP09 data and may have significant impact on port operations:

- Lack of information on future changes in frequency / intensity of wind / gales
- Lack of information on future changes in the frequency / intensity of lightning
- Lack of information on future changes in frequency / intensity of snow, sleet, blizzard, ice and freezing fog.

Although these characteristics may be caused as a result of climate change, further work will be required in the next update of the UKCP09 data to assess any expected increases in magnitude and the associated probabilities. It is noted that since the original assessment, the United Nations Framework - Convention on Climate Change (UNFCCC) Fifth Assessment Report has been published and in general, the level of certainty around likely impacts of climate change has improved.

8.2 ASSUMPTIONS

There are a number of fundamental assumptions that underpin FDRC's risk assessment. These are detailed below:

1. UKCP09 and other data, for example from the Met Office, is an accurate representation of the climate change that will occur
2. Energy infrastructure continues to operate fundamentally in the same way as it does today
3. Third party organisations whose business affects energy infrastructure resilience will continue to operate fundamentally in the same way as they do today.

4. There will be no extreme changes to population numbers or distribution profile across the country
5. Third party organisations such as, the highways agency and network rail are able to properly address the risks identified in their assessments.

8.3 BARRIERS TO IMPLEMENTING ADAPTATION PROGRAMME

Three common barriers to adaptation were identified in the original assessment.

There is a view that better evidence of, and confidence in, climate change impacts might be needed before adaptation actions could be taken. Without greater certainty, it will be difficult to make a commercial argument for investing in climate change adaptation.

This remains the case to a degree. There is now greater acceptance of the impacts of climate change, however, accurate and suitable data to inform business strategy still remains limited.

It was recognised that investing in climate change adaptation means taking long-term decisions which are sometimes incompatible with the investment timeframes of business.

While this barrier remains, climate change adaptation is increasingly considered in any significant new investment. For example, the port's proposed new logistics park is being designed to meet zone 3 flood risks. Previously, this would be considered zone 2 (See Appendix 2).

Normal business risks are often regarded as being more urgent than those posed by climate change, so there is limited pressure to invest many resources in this area of work at this stage.

Climate change impacts are increasingly being considered when any investments are made.

8.4 REPORT AND REVIEW

As part of the UKCIP project the following key success factors were identified:

- Key climate risks to the port identified
- The implications of climate risks have been understood and addressed
- Climate change is incorporated into the company risk register.

In order to monitor these factors, the HPUK Environment Committee continues to monitor and review the impacts and effects of climate change. Options for addressing key risks are identified, assessed and implemented as appropriate.

It is important to identify all internal and indeed external stakeholders involved with climate change adaptation. These departments are all represented on the HPUK Environment Committee:

- Health, Safety and Environment
- Port Development and Civil Engineering
- Procurement
- IT
- Marine and Ports Services
- Commercial
- Mechanical and Electrical Engineering
- Operations
- Legal
- Employees

8.5 RECOGNISING OPPORTUNITIES

As part of the UKCIP Project, key climate impacts to the Port were identified using the Business Areas Assessment Tool (BACLIAT).

As a terminal operator, the number of containers handled is generally more important than the contents of these containers, and therefore the business has some resilience against changing profiles of products which may be imported or exported as a result of climate change. However, as already mentioned, if the contents of the boxes require different handling processes, or require more refrigeration and therefore power use, there is a need to adapt current processes.

Another threat identified was that other factors, including oil supplies and the green agenda could reduce shipping worldwide, and that increased demand for locally sourced produce could reduce shipping volumes with a consequent adverse effect to business.

Conversely, greater use of low carbon modes within the supply chain, notably rail and coastal shipping, had opportunities for the port as it has good rail connections, and a greater critical mass to support viable coastal services.

Examples of possible future impacts are listed below.

Threats	Opportunities
All investments in the port are long term; retrofitting is expensive.	There is an opportunity to ensure all developments build in climate change headroom in a cost effective way.
Rubber-tyred gantries (RTGs) operate at higher height levels so are more vulnerable to wind	Establish more/better processes for measuring/monitoring the weather Collaborate with manufacturers to develop more robust designs
Higher sea levels will increase the risk of quays being overtopped	Higher sea levels may reduce the need for dredging within the Port

Appendix 1

Environment Policy Statement

POLICY

Subject	Environmental Policy Statement	Reference	2014_00009
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Objective

We recognise that all our activities interact with, and have some effect upon, the environment. We acknowledge that we have a responsibility to mitigate both the short and long-term effects of our operations upon the local, national and international environment, whilst maintaining the company's financial viability.

We are committed to compliance with all applicable legislation. Indeed, we go further than this and shall take a lead in developing improvements to energy efficiency and minimising the environmental impact of our operations in our industry.

We consider good environmental performance as a key management responsibility ranking equally with the other main company objectives. We will:

- Establish and maintain an environmental management system for monitoring and targeting environmental performance with a planned approach designed to achieve continual improvement.
- Set objectives and targets for improvement.
- Implement best practice to mitigate environmental impacts and prevent pollution.
- Promote awareness and personal responsibility on the part of employees at all levels.
- Engage with our customers, suppliers and other relevant stakeholders to maximise opportunities for improvement.
- Maintain our certification to ISO 14001 and ISO 50001

Scope

This policy applies to all our operations undertaken at the Port of Felixstowe, Harwich International Port, London Thamesport and any ancillary places of work.

Approved by:



Date:

21st November 2014.

CEO Hutchison Ports (UK) Limited

Supersedes:

Environmental Policy Statement 2011_0028



Appendix 2

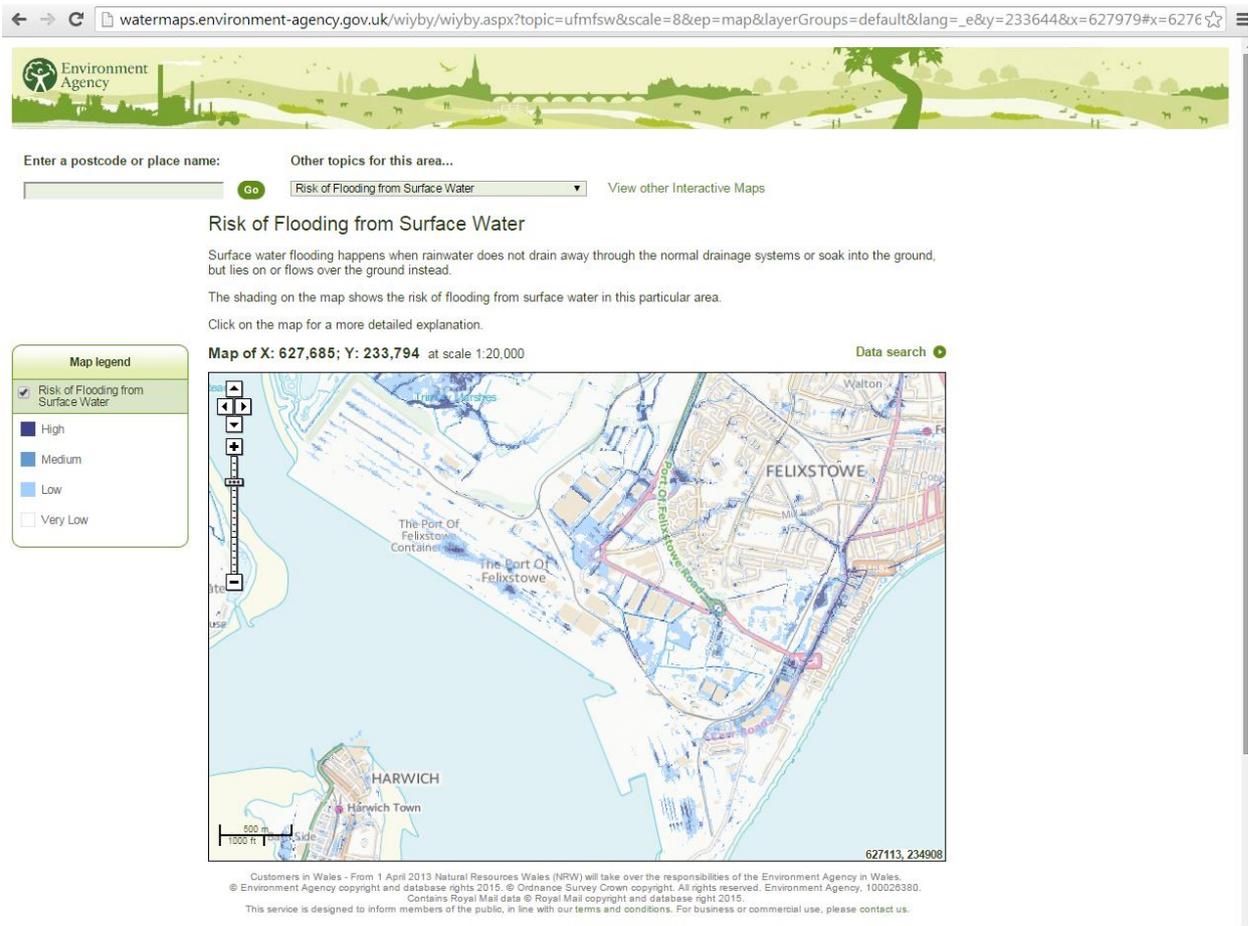
The Environment Agency (EA) advised that site (new developments at the Port of Felixstowe) was in Flood Zone 3 when climate change is taken into account. However, EA advised that the long term coastal strategy is to hold the line – accordingly the defences will be raised in line with actual sea level rise – source meeting with Environment Agency – 30/03/2015.



Flood Zone definitions are set out in the National Planning Policy Guidance:

- * Flood Zone 1 - land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
- * Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
- * Flood Zone 3 - land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year

Note: These flood zones refer to the probability of river and sea flooding, ignoring the presence of defences.



What does 'high' mean?

High means that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%). This type of flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm.

This is based on the best information we have available, such as ground levels and drainage.