



# PD Teesport Climate Adaptation Assessment Update

Report to Defra under the Adaptation Reporting Power

PD Teesport Limited

28 October 2014

Final Report

PB3006



*Cover photo: Water levels overtopping the quays during the 2013 tidal surge event (image PD Teesport Ltd)*



Rightwell House  
Bretton  
Peterborough PE3 8DW  
United Kingdom  
+44 1733 334455 Telephone  
Fax  
info@peterborough.royalhaskoning.com E-mail  
www.royalhaskoningdhv.com Internet

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Drafted by Daniel Beeden  
Checked by Dr Nick Cooper  
Date/initials check NJC.....  
Approved by Dr Matthew Hunt  
Date/initials approval MGH.....



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## **1 INTRODUCTION**

- 1.1.1 This report comprises an update to the Climate Adaptation Assessment (CAA) submitted by PD Teesport in early 2011. It considers weather events that have impacted the Port, measures that have been introduced since the 2011 study, and ways in which resilience has increased as a result of these measures.
- 1.1.2 The format of the report broadly follows that set out in the guidance document provided by Defra to guide organisations' responses to their request for an update on the CAA (*Climate Change Adaptation Reporting Power – how to report your progress in planning for climate change*, Defra 2013).

## **2 MARCH 2011 ASSESSMENT**

- 2.1.1 Recognising the need to ensure climate change adaptation measures are timely, appropriate and effective, Defra's 2009 Adapting to Climate Change programme highlighted a number of key organisations required to undertake dedicated climate change risk assessments. These organisations included those responsible for significant and critical UK infrastructure; namely airports, major highways, ports and railways.
- 2.1.2 PD Teesport Limited (PDT) is the statutory harbour authority for the ports of Teesport and Hartlepool. It is also the owner and operator of these ports, handling in excess of 50 million tonnes of cargo annually. Consequently Teesport is one of the top four ports in the UK in terms of volume of cargo handled.
- 2.1.3 In March 2010 PDT, as a Priority Reporting Authority, received a direction from the Secretary of State to undertake a climate change risk assessment under the Adaptation Reporting Powers. This risk assessment was designed to ensure that Reporting Authorities have taken the projected impacts of climate change into account, and have understood the associated risks to their respective operations. With this knowledge, informed and targeted actions can be taken to mitigate them. The Climate Adaptation Assessment (CAA) was completed and submitted to Defra in spring 2011.
- 2.1.4 Based on the conclusions of the CAA, several actions were identified that would help to mitigate future anticipated climate impacts on the port. One of these was to undertake a review and update of the CAA in 2014. The review would capture the impact of weather impacts on operations and infrastructure since the CAA and highlight changes (if relevant) in climate science and projections. The review would also capture progress made on commitments made in the CAA.
- 2.1.5 The planned review coincided with a request from Defra to all Reporting Authorities to voluntarily update their CAA. Defra are interested to learn what actions organisations have taken to embed climate adaptation into their day-to-day operations, and to understand the level of capacity to adapt. Information provided by Reporting Authorities will contribute to the next Climate Change Risk Assessment, due for publication in 2017.
- 2.1.6 The CAA (2011) concluded that no 'new' risks to the port and its operations had been identified. Rather, predicted climatic changes are expected to bring about a change in those conditions that the port is already well used to dealing with; either through an increase or decrease in frequency or the extent of an event. Operating within a dynamic environment, PDT (as with all port operators) must be prepared for adverse weather conditions including storm surges, high winds, high and low temperature extremes, and coastal erosion. The 2012 assessment identified three 'very high' risks that are repeated below.

*Sea defences adversely impacted or compromised by sea level rise and/or increased storminess*

- 2.1.7 This is an ongoing issue for PDT with regard to its statutory duties as a competent harbour authority. There are a number of sea defences for which the company has either full or partial maintenance responsibility. Condition assessments are undertaken regularly for these defences, which protect a range of infrastructure and properties within the port estate and outside. The nature and extent of any repair or maintenance works carried out on the sea defences is also under continual review and appropriate works are undertaken (guided by the local Coast Protection Operating Authority and the Environment Agency, and long-term strategic planning documents such as Shoreline Management Plans) in light of information relating to climate change and sea level rise.

*Road closure/damage to roads from flooding and resulting impact upon movement of cargo/equipment/people from the port to the surrounding road infrastructure, or vice-versa (i.e. closure of the A1053)*

- 2.1.8 A previous incident in which flooding impacted a large area of the dockside estate and access to the port was cut off occurred when rainwater overwhelmed the capacity of the local drainage system. Following the incident a number of changes were made to the drainage system and the way in which it is managed and maintained. The expected increase in rainfall has been discussed at workshops and the impacts that this may have upon drainage systems across the port estate considered. An ongoing maintenance regime will consider the need to increase drainage capacity to ensure that the infrastructure is able to cope with the predicted increased in rainfall over time.

*Flooding of quays through overtopping due to rising sea levels/high winds and swell conditions*

- 2.1.9 If realised this risk could have major consequences for the port and its operations. The port has an ongoing asset protection programme - a scheme of works to ensure that infrastructure and sea defences are maintained to the proper standards - in place. Defences will be upgraded or increased where necessary so that they can cope with predicted changes in conditions. It is likely that quays will be replaced for reasons other than climate change by the time sea levels rise to a problematic level. Any new quays will be constructed taking into account predicted increases in sea level. Adopted business continuity measures are designed to limit the adverse impacts of an event such as a major flood by protecting 'business critical' systems, services and infrastructure. This includes, for example, locating data storage centres off-site.

- 2.1.10 These were identified as the most significant of the 49 potential risks highlighted in the 2011 CAA.



### **3 UPDATE TO THE CLIMATE ADAPTATION ASSESSMENT**

3.1.1 Coinciding with a request from Defra and informed by the accompanying guidance, PDT undertook a scheduled review of the CAA during the third quarter of 2014. This update has been informed by Preparing key individuals across PDT's operations, including Group Projects Director (climate adaptation portfolio holder), Harbourmaster, Head of Health, Safety & Environment (HSE) and the Head of Business Continuity Management (BCM). The key actions that have informed the CAA update are as follows:

1. A review of climate change science and impact projections across the low, medium and high emissions scenarios as considered in the in the original CAA;
2. A review of if/how operations have been affected by adverse weather over the intervening period and the associated impacts and lessons learned;
3. A review of actions incorporated into the CAA and progress against each, as well as others proposed/introduced since; and
4. Identification of any further measures to reflect the outcomes of points 1-3 above.

### **3.2 Climate change impact projections**

3.2.1 UKCP09 data that was used to inform the CAA remains current and valid so the climatic changes and impacts set out in the CAA can still be considered relevant for the update. It was noted that emissions are currently trending towards the 'high' scenarios. Similarly, acknowledgement was given to the implications from long-term climatic change under a high emissions scenario.

### **3.3 Adverse weather events**

3.3.1 As a major port operator, PDT operates in all weathers throughout the year. The CAA considered in detail the anticipated impacts of climate change up to the 2050s including changes in temperature, storminess and rainfall. This current review includes consideration of weather events that have led to disruption or other problems at the Port during the period since 2011.

#### ***Tidal surge / high water levels***

3.3.2 In December 2013 a significant tidal surge event affected the east coast of England. A storm surge occurs when sea level is raised primarily owing to strong winds which 'pile up' the water against the coast. Low pressure centres can exacerbate this. The tidal surge at Teesport was the highest ever recorded and came within 15cm of overtopping the quays at Teesport. Two quays (Victoria and Deepwater) at Hartlepool dock (also the responsibility of PDT) were overtopped and a warehouse was flooded although damage to the building and stored materials was not significant.

3.3.3 This particular event was notable for the difference between the forecast (and therefore anticipated) storm surge and that which actually occurred. The highest level reached by the tide during this event was some margin above that predicted by the forecast models (although recorded winds were slightly less than forecast). Whilst the quay was not overtopped at Teesport, a number of nearby sites were badly affected; with flooding having significant impacts upon engineering and chemical works locally where flood defences were breached. Other sites around the Tees were also affected including substations that were rendered inoperative (leaving large residential areas nearby without power) and a chemical plant on the north side of the estuary that was partially flooded. No effects on the wider area arose as a result of these breaches.



**Figure 1.** Quayside and warehouse flooding during the tidal surge event at Hartlepool ((image PD Teesport).

### ***Access roads***

- 3.3.4 A key issue that was identified during the original CAA was the fact that Tees Dock itself is accessible by only one road, which is liable to flooding during intense rainfall events. This road, the A1053, was the subject of a number of resilience and interdependency concerns owing to the knock-on effects of a flood event resulting in a road closure which would render the port inaccessible to vehicles. This clearly has implications for the timely delivery and collection of freight, particularly consumables. Flood events have typically lasted for around 24 hours. One such event has occurred since the publication of the original CAA.

### ***Wind speed***

- 3.3.5 Sustained wind speeds of 22m/s or greater will result in the suspension of vessel operations at the port with any stoppages greater than four hours in duration being considered 'major stoppages'. Wind speed data is recorded by the Port and when compared against vessel scheduling information (winds greater than the threshold are not an issue if there are no vessels operating at the time) it reveals that 7.2 days were lost between May 2013 and October 2014. Anecdotal evidence suggests that 2014 has been particularly hard-hit in respect of crane stoppages (those cranes which transfer freight and containers between vessel and quayside) owing to adverse weather conditions.

### ***Other events***

- 3.3.6 The only other weather events of note were a number of especially large swell events driven by keen northerly and north-easterly winds resulting from intense high pressure weather systems over Northern Europe. These large swells prohibit the transfer of pilots onto container ships and tankers meaning vessels have to anchor outside the port resulting in significant and costly delays until cargoes can be unloaded. Two such events have occurred since 2011 with both resulting in disruption to port operations over a four to five day period.

### **3.4 Actions proposed, taken and underway**

3.4.1 The CAA proposed four key actions following the completion of the risk assessment process:

1. Undertake a full review of the CAA in 2014 to reflect changes in guidance, legislation, best practice and information relating to climate projections, observed weather and climatic trends as applicable;
2. Determine how to more effectively and comprehensively engage stakeholders and those organisations with whom PDT has identified interdependencies;
3. Introduce an internal awareness-raising programme to facilitate staff 'buy-in' and raise the level of understanding of the potential impacts of climate change; and
4. Identify a 'climate adaptation lead' who will have ultimate responsibility for climate resilience across the Port estate.

3.4.2 Since the adoption of the CAA the following measures have been introduced either as a result of the commitments made therein or subsequent events which have required a response.

#### ***Quay Replacements***

3.4.3 The renovation and replacement of quays across the estate is an ongoing process. One quay is currently in the process of being replaced and, when complete, will have its cope level (the elevation of the quay surface) increased by 50cm. Quays typically have a 50-80 year life and can be considered long-life infrastructure in the port environment; correspondingly they need to be resilient to future climate. This new quay is being built higher in large part to accommodate anticipated increased sea levels and the greater incidence of storm events, to ensure impacts on the Port from severe weather remain manageable, and in direct response to the 2011 CAA work. Whilst there are additional cost constraints from building the higher quay, and all future quay upgrades will be built to this standard or to reflect best practice guidance at the time.

#### ***Port entry/exit road (A1053) vulnerability***

3.4.4 Further remedial works have been undertaken over the past three years which have replaced drainage systems and seen new and increased maintenance programmes introduced. The latter have been designed to clear and de-silt drainage systems that are prone to blocking due to a low fall.

3.4.5 Co-operation with nearby landowners whose surface water runoff has historically drained into these systems (and contributing to its inundation during flood events) has also helped to remedy the situation. In addition the re-routing of pipes belonging to Northumbrian Water which spanned a small creek/beck (these acted as a dam when water levels in the creek were elevated thus contributing to flooding on the A1053) has helped to increase the resilience of that section of road to high rainfall events.

3.4.6 PDT, working in partnership with the Local Planning Authority, has purchased two high volume mobile water pumping units to deal with flood events on the A1053 but which can also be deployed anywhere on the site as required. The introduction of these new resilience measures on the A1053 also strengthened cooperation between organisations based at Teesport with which PDT has identified interdependencies.

## ***Interdependencies and cross-authority communication***

### *Humber Emergency Planning Forum*

- 3.4.7 Led by the Department for Transport (DfT), PDT have joined this ports-focussed local resilience forum to maximise opportunities for collaborative working to help minimise impacts from a wide range of sources including climate change.

### *Teesport Mutual Aid Meetings*

- 3.4.8 A large number of organisations based in and around Teesport are members of this forum designed to ensure mutual support during emergencies. Many of these organisations own or operate the numerous Control of Major Accident Hazards (COMAH) sites in the area where, due to the nature of their operations, a tidal surge or other extreme weather event could result in significant environmental, economic and social impacts.



**Figure 2.** Dawson's Quay showing the very high water levels during the 2013 tidal surge (image PD Teesport).

### ***Review of the impacts of the 2013 tidal surge event***

- 3.4.9 Although no long-lasting damage was caused to the Port and its operations, following the 2013 tidal surge a review is in preparation taking account of all elements of this event to identify and focus action on key vulnerabilities. This will reduce the risk to the port of similar (or worse) events in future.
- 3.4.10 During the tidal surge, it was evident that the Port needed to strengthen plans for evacuating mobile equipment and plant to designated 'high points' within the estate where it would be secure from flood damage. This is one such area where PDT is developing and progressing emergency planning in line with anticipated and observed weather events.
- 3.4.11 PDT now receives more frequent weather forecasts (port specific and twice daily) than in 2011. As visibility remains a key consideration for port operators, a number of automated visibility sensors have also been procured and are now operational; these offer continuous real-time visibility data to port authorities and vessels that are useful not

only in fog and mist but also during heavy precipitation. Localised fog is difficult to forecast and also to report by eye. Whether the incidence of fog events will increase under a changing climate remains unclear from modelling, but this step is an additional measure to ensure business continuity across the widest possible range of weather conditions.

- 3.4.12 Improvements in on-site generator technologies and capacity have also been made to ensure the provision of back-up power for all essential services is available if required.

## 4 CONCLUSIONS

4.1.1 This report is the first review of PD Teesport's climate adaptation programme. It also forms a response to Defra under the Adaptation Reporting Power for an update to the Climate Adaptation Assessment undertaken in early 2011. It presents a summary of key weather events that have impacted the Port during the intervening period, a review of the actions originally proposed as well as new ones undertaken and what additional measures are being taken/need to be taken.

4.1.2 Measures related to climate change impact mitigation that have been implemented or are underway are set out in Table 1 below.

Summary of action (as set out in first round report)	Timescale over which actions were planned	Progress on implementation of actions	Assessment of extent to which actions have mitigated risk	Benefits/challenges experienced
Undertake a full review of the CAA during 2014.	By end 2014.	Completed (by way of this report).	Provided a renewed focus on climate change impacts and the need to keep the issue at the forefront of Port resilience activities.	Bringing senior management from across all branches of Port operations together to focus on climate impacts has been positive for all.
To address interdependencies and key vulnerabilities with neighbours & stakeholders.	Ongoing.	Ongoing. Significant progress made on improving resilience of the A1053 with partners.	Much higher confidence that the road will remain operational in conditions which would previously have resulted in its inundation.	Key Port access route made more resilient to adverse weather. Fostered strong partnerships with a number of businesses located nearby. Wider engagement remains an ongoing action.
Improving climate resilience of Port infrastructure.	Ongoing and as required.	Underway.	Raising cope level of first quay due for refurbishment by 50cm; all remaining quays will be similarly refurbished in line with maintenance schedules. Port infrastructure increasingly resilient to rising sea levels and storm/tidal surge events.	Works will reduce vulnerability to climate change impacts without costing any more than a standard quay replacement. Sea defences for which PDT has statutory responsibility remain the subject of ongoing maintenance and review to ensure they are able to withstand current and future project sea levels.
Knowledge sharing and awareness raising	Ongoing.	Membership of and input to local resilience and emergency planning forums. Not solely focussed on climate change but capturing the mitigation and likely impacts.	Collaborative approach to preparing for and responding to severe weather events helps to mitigate risks for all partners. Sharing and pooling resources, expertise and incident response processes.	Greater resilience for all Port area owners and operators. Provides a more economical and beneficial approach to improving climate resilience. Remains challenging to give climate change a specific focus, given the relatively long-term duration and day to day priorities.

**Table 1.** A summary of implemented actions and those underway.

- 4.1.3 This review and update of the CAA has confirmed the validity of the original document and the key climate change vulnerabilities highlighted therein. As with the conclusions made in 2011, the anticipated impacts of climate change do not pose any 'new' threats to the Port; rather they serve to highlight changes to existing conditions that the Port has to be able to cope with.
- 4.1.4 This update has provided a renewed focus across our operations at the same time as facilitating a review of adverse weather events over the past three and a half years and how these have affected the Port.
- 4.1.5 The 2013 tidal surge did not cause significant issues for the Port however a very modest worsening of conditions could have caused much more serious problems. PDT have been successful in dealing with some key vulnerabilities such as the A1053 and greatly improving collaboration and partnership working with a range of nearby businesses, the emergency services and local planning authorities. Port infrastructure (quays) is being upgraded in line with projections of sea level rise and emergency planning and business continuity assessments continue to expand to ensure that future severe weather events such as storm or tidal surges do not have extensive or long-term impacts on the Port.

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