



Trinity House

TRINITY HOUSE PLANNING FOR CLIMATE CHANGE PROGRESS REPORT 2016

Understanding climate risk | Understanding uncertainties | Action plan review
Addressing barriers and understanding interdependencies | Monitoring and
evaluating | Opportunities and benefits

Image:
Longships Lighthouse by
Tim Stevens in 2008

1.0 Background

1.1 As a major infrastructure provider, Trinity House participated in the first round of Climate Change Adaptation Reporting, producing its first 'Climate Change Adaptation Report' in 2011. It has now been invited by DEFRA to provide an 'adaptation progress update' on this report, focussing on how our understanding of climate change implications has developed and what actions have been implemented to address those risks. This document comprises Trinity House's response to that invitation. DEFRA document 'How to report your progress in planning for climate change' has informed the structure of the report.

2.0 Understanding climate risk

2.1 The process of researching and putting together the Climate Change Adaptation Report was invaluable in developing Trinity House's understanding of climate change predictions. It gave us the opportunity to examine the potential impacts of climate change on our organisation and to ensure that 'climate change awareness' was an integral part of our planning and decision making process.

2.2 Because of its value to Trinity House, we have taken the opportunity presented by this adaptation progress reporting process to review our Climate Change Adaptation Report. The 2015 report is produced in the context of changing data on climate change. Since this first round report, the IPCC AR5 has superseded IPCC AR4. Whilst it would be fair to say that the overall thrust of this fifth assessment report by the Intergovernmental Panel on Climate Change, shows that the effects of climate change are likely to be more extreme than previously thought, it is not considered that this new data is material to our ability to pinpoint organisational vulnerability. Together with the UKCP09 (UK Climate Projections), the IPCC AR5 comprises Trinity House's primary source of data regarding climate change.

2.3 Trinity House also has access to its own data and on occasions commission research. For example, we record damage to buoys and the reason behind such damage and that allows us to build up a picture of risk and impact. As another example, Trinity House has worked with researchers at Plymouth University to assess the impacts of wave loading on rock lighthouses in the context of sea level rise and more energetic wave climates.

2.4 Since the 2011 report, there have been changes within our organisation and estate, and our own understanding of the potential impacts of climate change on our operations and estate has continued to evolve. Important relevant events in our estate include the decommissioning of Orfordness Lighthouse as a result of beach erosion (relationship to climate change not known), and the storms of 2012/13 that took a heavy toll on some of our landing stages.

2.5 As part of the 2011 report, a register of risks and projected register of risks was produced. This document served as a scoping report to feed into our Organisational Risk Register and our Environmental Plan.

3.0 Understanding uncertainties

- 3.1 Many uncertainties remain in the monitoring and evaluating of climate change risks to Trinity House's functions. It is noted for example that the social and political consequences of Climate Change (which ultimately may be the most severe) are almost impossible to address without entering into the realms of speculation.
- 3.2 Climate prediction is an uncertain science and the terminology used within reports such as the IPCC AR5 and UKCP09 inevitably reflect this. Different predicted rises in sea levels are put forward that depend on how successful the world will be on cutting emissions - and this is obviously an unknown.
- 3.3 Even were the precise future rise in sea levels, changes in temperatures and increase in storms known, the precise impacts of this on secondary factors affecting our estate and operations (for example erosion,) would remain unknown. In some areas there is very little data available. An example of this is in relation to potential increases in lightning strikes. Available data does not allow us to predict the extent to which our **Aids to Navigation (AtoNs)** will be more vulnerable to this than they currently are.
- 3.4 Most of these uncertainties result from 'information gaps' beyond the influence of Trinity House. Our own ability to plug such information gaps is largely limited to the surveying and monitoring that we undertake as a matter of course in relation to our estate and AtoNs. For example, where AtoNs or associated infrastructure are located in an area of geological vulnerability, regular surveys are undertaken that allow us to estimate life expectancy, mitigation potential and so on. Similar surveying of landing stages and other structures that are set against the forces of sea and weather are regularly undertaken for the same reasons. Such monitoring does not solely respond to Climate Change – it is work that would happen as a matter of course. Climate Change is undoubtedly an accelerator in the destructive natural forces to which the role of Trinity House has always been inextricably connected.
- 3.5 Trinity House has dealt with these uncertainties through its process of risk assessment and analysis. As the impacts of climate change on Trinity House's estate and operations is likely to be slow, it is expected that adaptation will be effected as part of our on-going asset management and investment plans.
- 3.6 'Information gaps' may of course refer to the availability of information internally within an organisation as well as to the organisation as a whole. Trinity House takes various steps to ensure that the necessary information is available to those that need it – not least by making our Climate Change Adaptation Report available to all staff. Our Executive Committee have been briefed on the impacts of climate change to our operation and climate change impact forms an integral part of our Organisational Risk Register. Climate change is covered within the remit of our Environmental Working Group that is currently organising 'road shows' to our various operational sites and ships. Climate Change is one of the topics being covered.
- 3.7 Trinity House is reliant upon the approach of external agencies in the adaptation of its AtoNs and estate to meet the challenges of Climate Change. It is also reliant upon the National and European law and policy that such agencies interpret, implement and enforce. Key external agencies with whom there is a high and regular degree of inter-dependency (and therefore, to some degree uncertainty) are;

- Local Planning Authorities, through their responsibilities in relation to Planning and Listed Building Consents.
- Historic England / CADW, through their responsibilities in connection to Listed Buildings and Scheduled Monuments
- Natural England / Natural Resources Wales, through their responsibilities in relation to protected species and designated sites
- Environment Agency / Natural Resources Wales, through their responsibilities in relation to flood defences.
- Marine Management Organisation, through their responsibilities in relation to marine conservation and licensing.

In many cases, these external agencies will be balancing competing priorities, and the need for Trinity House to undertake adaptive works related to climate change will not necessarily be their priority – or even a material consideration. In the case of Local Planning Authorities, there is a democratic element to decision making that further contributes towards unpredictability.

3.8 Uncertainty also exists in respect of external agencies on whom Trinity House rely for the provision of services. Utility providers for example have the potential to severely impact upon Trinity House’s operations. That example is expanded upon in sections 5.7 - 5.9 of this report.

3.9 A final area of uncertainty relates to the strategic business and methodological assumptions that underpin our analysis of impacts and risks, these are that;

- AtoNs will be required for general navigation into the long term future.
- There will not be material changes to the governance of Trinity House
- The resources available to Trinity House will not be materially decreased in real terms.

Any changes to such assumptions would be likely to necessitate a full review of our climate change adaptation strategy and our overall conclusion that we are able to adapt to Climate Change.

4.0 Details of actions: implemented and new

4.1 Implemented actions

The following table summarises the actions that were incorporated into the Register of Risks and Projected Register of Risks that formed part of Trinity House’s 2011 Climate Change Adaptation Report. It provided the scoping for Trinity House’s Organisational Risk Register, Environmental Aspects and Impacts Register, departmental risk registers and the Lighthouse Risk register which (together) comprise our auditable register of risks.

Each risk is set out and assessed in accordance with the guidance in DEFRA document ‘How to report your progress in planning for climate change’.

	Summary of actions (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
1	Strategic Plan (renamed Strategy)	2020	The Trinity House Strategy sets out our commitment to retaining ISO 14001 (Environment Management Systems) standards. This in turn requires us to consider climate change and has resulted in us embedding climate change adaptation considerations within every relevant project.	Very effective in ensuring cross-organisational awareness of issues at every level and in raising the profile of the Climate Change. In turn this has helped create a culture where climate change issues are embedded into the way that we think, plan and act.	Efficient deployment of resources Effective planning Maintaining reputation.
2	Asset Management Plan process including regular risk assessment	2020	Trinity House produces a 'Lighthouse Risk Register' that sets out the risks to each site. Climate change risks and site-specific monitoring requirements are now embedded within that document – for example erosion or low sea levels.	Very effective in monitoring and in feeding into the 10 Year Asset Plan (below)	Efficient deployment of resources Effective planning Maintaining reputation.
3	10 year capital programme allowing for flexible adaptation	2020	Trinity House's '10 Year Asset Plan and Engineering Strategy' in fact plans for the next 20-25 years. The plan covers each individual asset, explicitly factoring in flooding / sea level rise.	It has become evident that the greatest risk presented to our estate and AtoNs are at sites that are in any case vulnerable to sea and weather and that the primary impact of Climate change will be to reduce the (already limited) life expectancy of those AtoNs. To precisely what degree is unknown. The primary benefit of the Asset	Efficient deployment of resources Effective planning Maintaining reputation.

				Plan in addressing climate change is that it ensures that such impacts are factored into the long-term management or our assets.	
4	Use of floating AtoN on temporary basis	2020	This action is part of our contingency planning in the event of unexpected sudden events. Written protocols are held by our planning centre in the event of such events.	Our contingency planning allows us to minimise the risk of 'lights going out'	Maritime safety Insurance premiums minimised Legal liabilities avoided Reputation maintained
5	Insurance	2020	No new insurable risks have been identified that require insurance to be adjusted. Premiums take into account increased risks presented by climate change and our means of managing such risks	Insurance premiums are likely to rise if risk to estate or casualty of AtoNs increase to a significant extent. TH has identified that this is not likely and can be planned for and does not anticipate significant increases in insurance premiums resulting from climate change.	Risk of unplanned for increase in insurance premiums or uninsured for events assessed.
6	Cliff & Beach Monitoring	2020	This is on-going at sites with geological vulnerability (see Climate Change Adaptation Report for a list of those sites).	Regular assessment provides TH with a good awareness of long-term viability of sites and risk of casualty.	Minimised risk of AtoN failure and ensuring best-value use of resources. Maintaining reputation
7	Back up power systems.	2020	Every significant AtoN has a duplicate and independent power source. This is designed in accordance with the Trinity House's 'Principles of Design' document.	Risk of loss of power from anything other than a catastrophic event very low.	Minimised risk of AtoN failure. Maintaining reputation
8	Circa 90% workforce located in	2020	Of its 312 staff, 293 (94%) are based in coastal locations or	Coastal locations are cooler than inland locations, mitigating	Financial (cooling costs) and welfare.

	coastal locations or on-board ship		on-board ships. The remaining 19 are London-based and this accounts for just 6% of our workforce.	the impacts of rising temperatures on employees.	
9	Use of utility structure	2020	This action is part of our contingency planning in the event of unexpected sudden events. Written protocols are held by our planning centre in the event of such events.	Our contingency planning allows us to minimise the risk of 'lights going out'	Maritime safety. Insurance premiums minimised. Legal liabilities avoided. Reputation maintained.
10	Better understanding of relationship (if any) between severe weather and maritime casualties	2020	Our understanding is constantly evolving as we analyse publicly available data and our own information. For example, damage to floating AtoNs is recorded together with the cause (e.g. weather). It is notable in that example that particularly stormy years result in higher casualty numbers and a much higher percentage of such casualties attributed to weather.	By identifying the cause of damage (e.g. weather), we are able to assess whether design changes are required and analyse in cost-benefit terms what action to take.	Minimised risk of AtoN failure. Maintaining reputation. Efficient use of resources.
11	Revised working patterns in TH vessels	2020	No revised working patterns in TH Vessels have, as yet, proved necessary as a result of climate change.	No mitigation at this point in time	N/A
12	Boat landings raised where necessary	2050	Major repair works or to landings are not undertaken without first considering the benefits of raising their height to respond to climate change.	This approach minimises the risk (for example) of costly repairs being undertaken that will not have a lifespan to justify that expense.	The approach ensures that resources are efficiently deployed and minimises waste.
13	e-navigation in place with DGPS	2050	E-navigation is an emerging concept yet to be fully embraced	DGPS provides a high-integrity support to the established and	

	terrestrial backup		by the maritime community. DGPS continues to be maintained and delivers a reliable high-integrity support to GNSS	ubiquitous, yet vulnerable GNSS.	
14	Monitor climate change predictions	2050	Climate change predictions have continued to be monitored, the IPCC AR5 report being the primary change in source data since Trinity House's 2011 Climate Change Adaptation Report was produced.	Increased sea level rises predicted by AR5 (compared with those predicted by AR4) feeds into strategic planning plus the decision making process for each major project, mitigating risk of inappropriate investment and failure to plan.	Implementation of action has ensured that resources are appropriately allocated - eg. all 'Project Initiation Documents' (PIDS) incorporate climate-change section to ensure that provision has been made and the long-term viability of the works /AtoN have been factored in.
15	Monitor Harwich Flood defences with Environment Agency	2020	Recent (2015) meetings with Environment Agency representatives have reviewed operating arrangements for flood gates.	Review of flood gate arrangements ensures that lines of responsibility are clear in the event of spring tides / surge events.	Ultimately, the level of flood protection in Harwich is a matter for the Environment Agency and the risk to people and housing is a higher priority than the business operation of TH and others.
16	Ensure robust contingency arrangements in place in event of loss of a lighthouse	2020	This action is part of our contingency planning in the event of unexpected sudden events. Written protocols are held by our planning centre in the event of such events (whether as a result of climate change or otherwise).	Our contingency planning allows us to minimise the risk of 'lights going out'. However, no currently operational lighthouses are in imminent threat as a primary result of Climate Change.	Maritime safety, minimising insurance premiums, legal liabilities, maintaining reputation.
17	Prepare for Harwich depot pier replacement	2020	Using currently available predictions for sea level rises, the pier should remain viable for some time to come. With the point at which it becomes unviable	No major investment into the pier or dependant on the pier will be made without considering its likely life span in the context of climate change.	Efficient use of resources.

			some time away, no active plans are being made as yet for its replacement as by this point, our needs and the opportunities available may be quite different.		
18	Work with Environment Agency to enhance sea defences	2020	See action No.15		
19	Consider maintaining increased stocks of items of strategic / critical supply	2020	This action relates to the likely increase demands for summer cooling and resulting difficulties in suppliers meeting orders. No such difficulties have as yet been encountered and so no decision has been taken to increase such stocks.	N/A	None
20	Monitor sea levels and impact on TH estate.	2020	Climate change predictions have continued to be monitored, the IPCC AR5 report being the primary change in data since Trinity House's 2011 Climate Change Adaptation Report was produced.	As with action point no.14, increased sea level rises predicted by AR5 (compared with those predicted by AR4) feed into strategic planning plus the decision making process for each major project, mitigating risk of inappropriate investment and failure to plan. Differentiating the additional impacts of raised sea levels from the impacts of the elements that would in any case be experienced is problematic.	As with action point No.14, Implementation of this action has ensured that resources are appropriately allocated - eg. all 'Project Initiation Documents' (PIDs) incorporate climate change section to ensure that provision has been made and the long-term viability of the works / AtoN have been factored in.

21	Helicopter access to many Lighthouses	2020	Trinity House has helicopter access to many of its stations and in some cases this is the only practical means of access. None of our sites that do not already have helicopter access have been identified as requiring it as a result of climate change or for other reasons. A cost-benefit analysis takes place as and when land / sea access investment may be required, factoring in the impacts of climate change and the alternative option (if available) of developing helicopter access.	Risk of inefficient use of resources reduced.	Efficient use of resources.
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4.2 New actions

	Further or new actions planned	Risks addressed by actions	Timescale for new / further actions planned
1	Review and update TH Adaptation to Climate Change Plan.	Ensure that this plan is up-to-date in terms of best practice, climate change data, our estate, and new risks identified	2015/2016
2	Establish environmental effects of wave loading on Lighthouses	Better understanding of the resilience and longevity of rock lighthouses in the context of climate change	2015/2016
3	Conduct Environmental Working Group road show around Service	Raise awareness of environmental issues affecting TH (specific section addressing Climate Change Adaptation)	2015/2016
4	Modernise Longstone Lighthouse to include use of solar power	Improved self-sufficiency and resilience of station. Reduction in use of fossil fuel and carbon emissions.	2015/2016
5	Investigate if change needed to the solar model (used for calculating nos. solar panel)	Ensure that new & existing solar installations adequate in context of reduced sunlight hours associated with climate change	2016

5.0 Addressing barriers and understanding interdependencies

- 5.1 Trinity House has not to-date been in a position where it has had to implement works solely or primarily for the purposes of adapting to climate change. It has sought to undertake works which relate more generally to weather and sea resilience. It has also undertaken works that improve the sustainability of its stations and assist in the ability of a site to adapt to the impacts of climate change. In some cases such planned works have been refused by the relevant authority.
- 5.2 The interdependencies described in paragraph 3.7 can be a barrier to actions needed in order to address climate risk. Other agencies have different priorities to balance in their decision making process. A Local Planning Authority, for example, must consider whether the benefits of solarisation of a lighthouse or the raising in height of a landing stage are outweighed by the impacts on the appearance of a landscape or the character of a listed building. Trinity House has experience of proposals that assist in climate change adaptation being refused Listed Building Consent. Whilst adapting to climate change may be a material planning consideration, in most cases, the benefits of the means of adaptation proposed will be too intangible to be given significant weight.
- 5.3 A large proportion of our AtoNs are in national and European designated sites. If works are seen as having the potential to harm a European designated site (however small or necessary those works or impacts may be), the research, mitigation and justification required can be onerous, discouraging and sometimes futile.
- 5.4 Obviously, a key element of Natural Resources Wales / the Environment Agency's responsibilities include the provision and maintenance of flood defences. Generally such services are, by their very nature, beneficial to Trinity House's ability to address climate risk. However, to some degree, the long-term resourcing levels of flood defences, and the focus of such resources are unknowns as much to the Environment Agency as to Trinity House.
- 5.5 Furthermore, like other external decision makers affecting Trinity House's ability to adapt to climate change, the Environment Agency must weigh up competing demands and interests – for example, from Natural England or Natural Resources Wales to remove (or to cease to maintain) flood defences that can be seen as 'unnatural interventions'. Trinity House has experience of situations where it has not been able to adequately protect its site from erosion due to habitat concerns and indeed where a site has been put at significantly increased risk of erosion so as to improve a designated site from a habitats perspective.
- 5.6 In the main, however, Trinity House has been able to address such barriers. This is, in part, due to the positive way in which we view interdependencies. We have developed constructive relationships with agencies with whom we are interdependent and work hard to develop mutual understanding. Generally, the challenges presented by competing requirements results in innovation in order to find a mutually beneficial outcome.
- 5.7 As well as interdependencies with decision-making agencies, there exists interdependencies with providers of services. For example, the provision of utilities to our sites. In terms of our aids to navigation, we adopt a risk averse approach to this, ensuring that there is always a back-up. For example, at our lighthouses back-up generators are available if the primary supply is cut (for example by a storm) and this together with large banks of batteries, ensures that power is available until engineers

can be brought to site. Except for rock stations, most lighthouses have a local attendant who can be called upon to attend at short notice and our ships and helicopter will also attend where required. All lighthouses are monitored real-time from our Harwich depot's 'Planning Centre' so that it is known immediately if there is such a problem on site.

- 5.8 The Planning Centre has its own back-up generator in the event of a power cut. Trinity House's Business Continuity Plan addresses such eventualities as a flood or other significant event (climate change related or otherwise) that would prevent the use of the Harwich offices. For instance, the Planning Centre and other key staff would mobilise, on a temporary basis, to the London office. Arrangements would be made for other staff to work from home or at another location, on a temporary basis. Trinity House has web-based access to its primary resources that facilitate remote working and has alternative servers in London.
- 5.9 The Planning Centre currently provides out-of-hours monitoring of aids to navigation that are the responsibility of the Northern Lighthouse Board (NLB) and the Irish Lights. Were there to be a major event that affected NLB's and/or the Irish Lights' ability to monitor during office hours, provision is made for Trinity House to fulfil that function too.

6.0 Monitoring and evaluating

- 6.1 Climate change has been effectively embedded into our decision making and planning processes. Climate Change risks are considered throughout the organisation and are inter-woven within our project management methodology.
- 6.2 Trinity House works to an Environmental Management System that is certificated as being in conformance with the **ISO 14001** standard. This international standard requires organisations to establish an environmental management system, the aim of which is *"is to provide organizations with a framework to protect the environment and respond to changing environmental conditions in balance with socio-economic needs. It specifies requirements that enable an organization to achieve the intended outcomes it sets for its environmental management system"*.
- 6.3 The standard makes specific reference to climate change adaptation. It addresses how we deploy resources, ensure staff competence and awareness, how we undertake our operational planning and control, how we provide emergency procedures and response, and how we evaluate performance and feed that into improvements.
- 6.4 Key to compliance with the standard is maintaining an Environmental Policy that provides a framework for setting environmental objectives and includes a commitment to the protection of the environment, and other specific commitment(s) relevant to the context of the organization (including climate change). At Trinity House, the Environmental Policy (Health & Safety & Environmental Objectives Policy) is reviewed annually and specifically refers to climate change and includes a commitment to "Assessing all identified risks to its ships, personnel and the environment and establish appropriate safeguards"
- 6.5 Our Environmental Policy informs our Environmental Plan (Aspects & Impacts Register & Corporate Environmental Plan) which is reviewed quarterly. An Environmental Working Group monitors the implementation of that plan. Examples from the 2015/15 Environmental plan that relate to climate change adaptation include;

- Review and update TH Adaptation to Climate Change Plan.
- Establish effects of wave loading on Lighthouses in the context of climate change's potential to cause sea level rise and more energetic wave climates. (working with researchers at Plymouth University)
- Conduct Environmental Working Group road show around Service to raise awareness of environmental issues affecting TH.
- Modernise Longstone Lighthouse to include use of solar power and reduction in use of fossil fuel and carbon emissions.

6.6 Trinity House's 'Schedule of Organisational Business Risks' also incorporates climate change risk at its heart. It specifically refers to climate change in relation to;

- AtoN Provision (risk of loss of AtoN provision due to land erosion and/or increased frequency of storms)
- Exploitation of Reserve Capacity
- Project Management (climate change / natural event disruption)
- Asset Loss / Damage
- Health, Safety & the Environment

The potential consequences are set out, together with risk estimation, control and treatment, actions and monitoring responsibilities.

6.7 Trinity House furthermore produces a 'Lighthouse Risk Register' that sets out the risks to each site. Climate change risks and site-specific monitoring requirements are now embedded within that document – for example erosion or low sea levels.

6.8 This in turn links in with a '10 Year Asset Plan and Engineering Strategy' – a document that in fact plans for the next 20-25 years. The plan covers each individual asset, explicitly factoring in flooding / sea level rise.

6.9 Project initiation documents are then drawn up for any projects required in the 10 year asset plan. Templates for project initiation documents ensure that no project is initiated without consideration of the impacts of climate change. This ensures that works are able to respond to the impacts of climate change or at least that a realistic life-span for the investment is known and understood before any finances are allocated.

6.10 Within Trinity House, we have avoided partitioning climate change responsibility into the remit of a particular department or group, however our Environmental Working Group holds the responsibility for monitoring cross-organisation implementation of our climate change action plan and changes in climate change data.

6.11 Internationally, Trinity House has taken a prominent role in its field. It is a founder member of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). IALA has 78 National members, and a further 181 industrial and Associate Members. Its motto as set out in the 2014-2016 strategic vision is "safer voyages, sustainable planet". Trinity House provides the chairperson for 3 of their 7 technical committees (Northern Lights provides a fourth), and sits on its Policy and Advisory Committee Panel. In March 2010, Trinity House presented on the subject of 'Global Warming Challenges and Opportunities' to the IALA Council meeting at Cape Town. Trinity House provided the Engineering & Sustainability Committee of IALA with an update following the 2013 IPCC AR5 report and is due to report again in 2017.

- 6.12 Our approach translates into results on a practical level. As an example, following the particularly severe winter storms of 2013-2014, which caused some damage to floating AtoNs, the designs were reviewed and in some cases, design changes were made in order to improve their durability into the future.
- 6.13 A further example relates to our complex buoys (those that carry additional hardware such as RACON, AIS and GPS). The buoys carry batteries which are charged by solar panels. They rely on sufficient sunlight in the sunnier months providing enough back-up charge to provide reserves for the duller months. The power to a number of our complex buoys has been failing recently. Were this just one or two, it could have been put down to individual mechanical fault or damage, however it was more prevalent than this. On investigation, using Met Office information, it was ascertained that November 2015 had been the duller since records began in 1929, and the duller month overall since January 2013. Only 36.6 hours of sunshine were recorded, which is 64% of the long term average (1981-2010). This explained why insufficient energy reserves in the batteries were generated in order to allow the buoy to function through the winter. Trinity House utilise a solar model, setting together factors such as number of panels, storage capacity, predicted daylight hours (factoring in latitude etc.) in order to calculate what equipment is necessary to supply the buoy's needs through a calendar year. Potential for duller months (possible connected to climate change) has now been factored into this model.
- 6.14 Trinity House has taken a flexible approach to climate change adaptation. Solutions have not been imposed through a top-heavy approach, but rather the focus has been on embedding Climate change into the organisation's approach at every level. This ensures that the climate change is always considered and that the right solution is reached depending on the site-specific circumstances. It also ensures that we can keep informed of, and adapt to changing data and best practice.
- 6.15 Trinity House is confident that its approach has brought financial benefits. These benefits are however extremely difficult to quantify. It is difficult to de-couple the impacts of sea and weather from the exacerbated impacts of the same that result from Climate Change. Furthermore, the predicted impacts of climate change are based on different scenarios and that complicates cost-benefit analyses.
- 6.16 Trinity House is aware of other Climate Change Adaptation standards and guidance – for example, BSI publication: BIP 2178:2011: (Climate change adaptation: Adapting to climate risks using ISO 9001, ISO 14001, BS 25999 and BS 31100) that is a guide to identifying future climate risks and embedding the management of those risks in an existing management system. However, Trinity House is satisfied that its existing management system meets its requirements in this regard.

7.0 Opportunities and benefits

- 7.1 Climate change presents opportunities as well as threats. Those in a position to provide services and products to assist in climate change adaptation stand to benefit from what may become a growth industry in a similar way to the renewable energy sector of recent years. Whilst currently in the process of investigating new business opportunities, Trinity House has not to-date specifically investigated its potential to exploit such opportunities in relation to climate change adaptation. Such opportunities are considered to be limited bearing in mind Trinity House's charitable status and its charter.
- 7.2 One potential opportunity that has been identified lies outside Trinity House's core business. Trinity House retains a portfolio of former lighthouse keepers' cottages. Their unique heritage, position and context mean that many of these are ideal as holiday accommodation and they are let as such. Warming British summers combined with increasingly expensive foreign travel may well lead to an increase in popularity of the British holiday and so, increased income from these cottages.

8.0 Summary

- 8.1 The direct and indirect results of increased storms and rising sea levels have been identified as having the greatest impact in respect to Trinity House's function, operation and estate. Such forces do not present new challenges to Trinity House. They are an exacerbation of the challenges that Trinity House has always worked with. The engineering challenges presented by sites that through locational necessity are exposed to wave action, erosion and lightning strike have always been present and Trinity House has significant expertise in this field.
- 8.2 The ability of Trinity House's AtoNs and estate to withstand the impacts of weather and sea has therefore always been an integral part of its strategic and day-to-day planning and decision making process. The exacerbating impacts of climate change on the weather and sea is also now successfully embedded into our processes. This has assisted us in ensuring that we use resources efficiently so that 'the lights stay on'. Increased precision in climate change predictions will enhance such planning and decision making and changing data and interpretation will continue to be monitored.
- 8.3 Overall, Trinity House remains confident of its ability to adapt to Climate Change.