

**First Round Methodology (APPENDIX C)
Climate Change Adaptation
Second Round**

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30 May 2015

5. METHODOLOGY

5.1 Rationale

Almost every aspect of UK life will be impacted in some way by climate change. This is significant for Portsmouth Water because the Company assets are long term and decisions taken now will have consequences for many years. Understanding how climate change will impact upon the business, our stakeholders and our organisational objectives will allow existing and emerging risks to be identified and prioritised for action. This will enable adaptation to be built in to our internal planning and risk management processes.

Preparing for climate change proactively will reduce costs and allow the identification of opportunities. It allows flexibility in adaptation to be maintained, avoiding reflex, reactive adaptation and lock-in to a single adaptation response.

5.2 Approach

The assessment takes an organisational, rather than solely site-specific approach, considering both asset-level and business-level risks in terms of how these may impact the delivery of our business functions.

This includes considering impacts upon our assets, plans and operations as well as impacts on our customers and stakeholders. Specifically, this draws on a twin-track, iterative approach of:

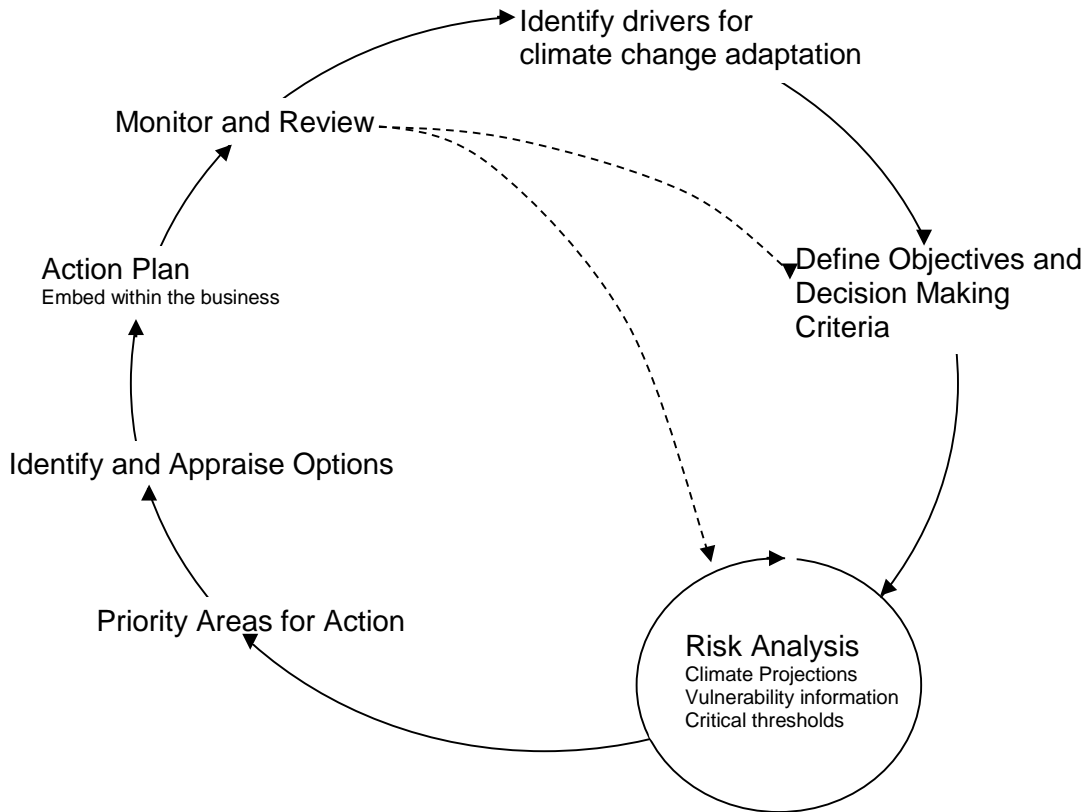
- Considering the current and future vulnerabilities of the Company's assets and operations to aspects of climate and weather
- Considering the Climate Projections in detail and identifying how a changing climate may impact upon the business.

5.3 Overall Methodology

Our methodology is adapted from the UKCIP, Environment Agency and Defra 2003 framework¹ in order to align with the Company's existing planning and risk management processes. This is illustrated in the figure below.

¹ UKCIP, Defra and Environment Agency. 2003. Climate Adaptation: Risk, Uncertainty and Decision-Making.

Portsmouth Water's Climate Change Adaptation Framework



Identifying Drivers

Drivers for adapting to climate change include statutory duties to maintain safe, reliable water supplies.

Define Objectives and Decision-Making Criteria

Objectives are determined by the Company's aims and missions and assessed by business function. Decision-making criteria bring together those utilised in the Company's existing risk management mechanisms.

Priority Areas for Action

Priority areas for action are determined from aggregated risks and interdependencies.

Identify and Appraise Options

Options are identified and appraised according to financial and socio-economic criteria and the risk reduction achieved.

Action Plan

The Action Plan will embed adaptation actions in to the Company's existing risk management mechanisms.

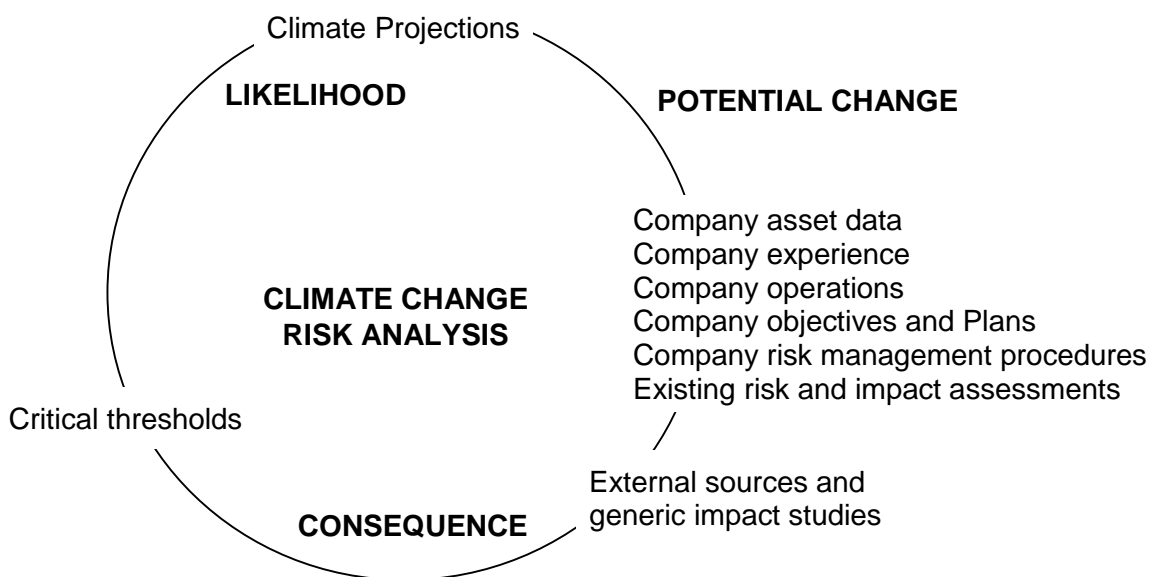
Monitor and Review

Mechanisms for monitoring critical thresholds and residual risk are identified, and mechanisms for future review to identify success and barriers to implementation.

5.4 Climate Change Risk Assessment Methodology

The risk assessment methodology is an iterative process, bringing together an understanding of the range and uncertainty of possible future climate from the Climate Projections with detailed information on the Company's assets, past experience, operations, objectives, risk management procedures and plans. The Company already has an appreciation of the types of impacts we can expect from climate change. For example, the Company has included climate change impacts in our Water Resources Management Plan, and has undertaken a Flood Resilience Assessment which has led to practical improvements at key sites. Understanding of some impacts, such as those on the water supply-demand balance, is necessarily more comprehensive than understanding of other impacts.

This analysis builds upon past work to identify and assess climate change risks in a coherent way and to quantify risks using a common framework. The figure below illustrates the process.



In detail, the components of this process are as follows:

5.4.1 **Review the UK Climate Projections 2009 in detail for our area**

Develop a comprehensive understanding of the possible climates we may be exposed to in the future according to current science, including an appreciation of the probability, uncertainty and limitations of the Projections. Once critical thresholds have been identified from Company data, likelihood and certainty by a given point in time can be determined from the Projections.

5.4.2 **Company Information**

The Company information this risk assessment draws upon includes the following:

- Company asset data
- Company operational activities
- Company past experience of climate and weather vulnerabilities
- Company strategic objectives and Plans, including:

- Portsmouth Water Strategic Direction Statement
- Portsmouth Water Water Resources Management Plan
- Company risk management procedures and Plans, including:
 - Drinking Water Safety Plans
 - Business Continuity measures
 - Emergency Plan
 - Drought Plan
- Existing risk assessments including:
 - Flood Resilience Assessment 2009
- Portsmouth Water Final Determination 2009
- Business engagement with planning, operations and management personnel specific to this assessment

5.4.2.1 *External sources and generic assessment*

To carry out this assess the Company draw upon a number of external climate change impact studies including:

- Adaptation Sub-Committee of the Committee on Climate Change (2010) How well prepared in the UK for climate change?
- AEA (2010) Adapting the ICT Sector to the Impacts of Climate Change
- Cabinet Office (2010) Sector Resilience Plan for Critical Infrastructure 2010
- Chatham House and Global EASE (2009) The Vulnerability of Energy Infrastructure to Environmental Change
- Defra (2010) Engineering, Infrastructure and Climate Change Adaptation Conference: Engineering to ensure long-term climate resilient infrastructure. Report of Proceedings 1st December 2009, The Royal Society, London
- Environment Agency (2009) Test and Itchen Catchment Flood Management Plan
- Environment Agency (2009) climate change, adapting for tomorrow
- Environment Agency (2009) Arun and Western Streams Catchment Flood Management Plan
- Highways Agency (2009) Climate Change Adaptation Strategy and Framework – Revision B
- HM Treasury (201) National Infrastructure Plan
- MWH (2007) Water UK: A Climate Change Adaptation Approach for Asset Management Planning 41414874 V1.0
- Pricewaterhouse Coopers LLP (2010) Adapting to Climate Change in the Infrastructure Sectors
- Royal Commission on Environmental Pollution (2010) Adapting Institutions to Climate Change

- UK Climate Impacts Programme (2005) Measuring progress: preparing for climate change through the UK Climate Impacts Programme.
- URS (2010) Adapting Energy, Transport and Water Infrastructure to the Long-term Impacts of Climate Change, RMP/5456.

5.4.4 Business Functions

Risks are assessed against the following business functions:

5.4.4.1 Supply Business Function

The supply business function is comprised of three activities; the water resources activity, the abstraction activity and the raw water quality activity.

Water Resources Activity

The water resources activity is the process of strategically managing the supply/demand balance and preparing the statutory 25 year Water Resources Management Plan.

Abstraction Activity

The abstraction activity is the operational activity of sourcing water of sufficient quality and in sufficient quantity, and has a number of assets associated.

Raw Water Quality Activity

The raw water quality activity is the process of managing water quality risks in our raw supplies which arise due to other catchment operators and hydrogeological properties of the region.

5.4.4.2 Raw Transportation Business Function

Raw transportation is the function of transporting raw (untreated) water, either for nitrate blending purposes or to a treatment works.

The function has a number of assets associated such as pumps and mains.

Water quality risks which arise in the raw transportation stage are included here as this is in line with our Drinking Water Safety Plan (DWSP) methodology.

5.4.4.3 Raw Storage Business Function

The Company has very limited raw water storage facilities. This function is limited to a single concrete structure located on site at one treatment works.

Water quality risks which arise at this stage are included here as this is in line with our DWSP methodology.

5.4.4.4 Treatment Business Function

Treatment is the process of treating water to potable standards through mechanical and chemical means, and has a number of assets associated.

Water quality risks which arise at this stage are included here as this is consistent with our DWSP methodology.

5.4.4.5 *Potable Storage*

Potable storage is the process of storing water in service reservoirs from which water feeds to the customers' tap.

Water quality risks which arise at this stage are included here as this is consistent with our DWSP methodology.

5.4.4.6 *Potable Transport*

Potable transport is the process of transporting water from a treatment works to a service reservoir, and from the service reservoir to the customers' tap.

The function has a number of assets associated.

Water quality risks which arise at this stage are included here as this is in line with our DWSP methodology.

5.4.5 **Quantifying Risk**

Risk is quantified according to existing Company procedures, where 'risk' is determined from a measure of consequence and likelihood, as follows:

$$\text{Risk} = \text{Consequence} \times \text{Likelihood}$$

The assessment of consequence and likelihood is quantitative, using a scoring methodology from 1 to 5 as defined in the table below.

Risks were assessed in the Near (0-30 years), Medium (30-60) years and Long (60+ years) term.

These risk rankings were adapted from existing risk rating methodologies used across the business, within the Drinking Water Safety Plan, capital maintenance planning, water resources planning and resilience assessment.

This enables, for example, climate change risks on different aspects of the business to be compared. As this risk assessment was strategic in nature, where necessary we put a value (consequence score) on the increase in risk of a given pressure driven by climate change. This is particularly the case when assessing risk associated with extreme events with a given return period, such as floods and storms. As the return period decreases, and risk increases, we score the consequence to provision of service of operating under higher flood or storm risk overall, rather than assessing the impacts to a site of a flood or storm event. This alone would not reveal the risks to service provision, due to network connectivity and other resilience measures the Company has in place to protect supplies.

| Score | Likelihood of critical threshold being exceeded | Consequence Score if critical threshold exceeded | Consequence for service (Water Resources and Abstraction) | Consequence for service (Water Quality) | Consequence for asset and environment. | Consequence for Company |
|-------|---|--|---|--|--|--|
| 1 | Very low / Negligible (1 in 1000) | Negligible | Negligible | Negligible | Negligible | Negligible |
| 2 | Unlikely (1 in 100) | Minor (low) | Moderately affecting source of normal daily output maximum of ≤ 20 Ml/d | Aesthetic impact for 1 consumer | Minor environmental impact. Minor asset loss. | Minor financial costs incurred. Minor disruption. |
| 3 | Moderately likely; 50/50 (1 in 50) | Moderate | Significantly affecting source of normal daily output maximum of ≤ 20 Ml/d. Moderately affecting source of normal daily output maximum of 20-40 Ml/d. | Aesthetic impact for up to 10 consumers Up to 10 discoloration contacts Up to 2 taste and odour contacts | Moderate environmental impact. Moderate asset loss. | Moderate financial costs incurred. Moderate disruption. |

| | | | | | | |
|---|-----------------------------|-----------------------|---|---|---|--|
| 4 | Highly likely (1 in 10) | Significant (high) | Significantly affecting source of normal daily output maximum of 20-40 MI/d. Moderately affecting source of normal daily output maximum of >40MI/d | Potential health related impact for up to 10 customers. Aesthetic impact up to 1000 customers. Over 50 discoloration contacts. 5 or more taste contacts. Actual multiple failures of one or more standards. | Significant environmental impact. Significant asset loss. | Significant financial costs incurred. Significant disruption. |
| 5 | Inevitable (Once a year) | Major (very high) | Significantly affecting source of normal daily output maximum of >40 MI/d | Potential health related impact for more than 10 customers. Aesthetic impact for over 1000 customers. Actual multiple failures of one or more standards. | Extensive environmental impact. Major/critical asset loss. | Major financial costs incurred. Major disruption. |

5.4.6 Critical Thresholds

From this process, critical thresholds of climate impacts are identified where applicable and practicable.

For some aspects a critical threshold can be clearly identified because there is little interconnectivity with impacts of other climate variables and impacts on other company activities or stakeholders. For other aspects however, critical thresholds are much more difficult to determine. This is especially the case in water resources planning, where the impacts of climate change are incremental but the criticality of an individual impact depends upon interactions and impacts elsewhere.

Once critical thresholds have been identified, the probability of exceedence of the threshold can be determined from the Climate Projections.

5.4.7 Certainty

Confidence in each assessment is rated qualitatively as **high, medium and low** and any assumptions made are clearly stated.

5.4.8 Findings

Results are presented in a risk table for each business function in Section 7. In Section 8 of this report, all risks are brought together and presented in a risk matrix to allow risk prioritisation and the identification of priority areas for action.

5.5 Adaptation Planning Methodology

5.5.1 Priority Areas for Action

Risks are prioritised according to the outcomes of the risk assessment, which assessed the consequence and likelihood of each risk to the Company's functions. High scoring risks, high uncertainty-high consequence outcomes and interconnectivities identified in the risk assessment define the priority areas for action.

Priority areas for action are grouped according to the lead time of the critical impact, i.e., whether they are near (0-30 years), medium (30-60 years) or long (60+ years) term risks.

5.5.2 Decision Making Criteria

Options for risk management are identified and those already being undertaken are described. The decision making criteria for appraising options, based on the priority areas of action, are defined as follows:

(1) Lead time of critical impact

Whether this is a near (0-30 years), medium (30-60 years) or long (60+ years) term risk

(2) Lead time of response

The time taken for a particular response to be implemented, assessed as short (< 1 year), medium (1-5 years) or long (5+ years). For example, changes to operational procedures can be implemented relatively quickly (<1 year), whereas capital scheme responses may take several years.

(3) Cost of action

The financial cost of the response, and where appropriate, the social and environmental costs assessed using mechanisms such as the shadow price of carbon.

(4) Benefit of action

The benefit of undertaking the response; incorporates a measure of the risk reduction and any additional benefits of the proposed measure, if applicable.

(5) Certainty

Certainty in the risk assessment findings was assessed as low, medium and high.

Many of our adaptation actions and plans are simply commitments to incorporate climate change risks in to future decisions, in order that climate change adaptation planning is embedded within risk management and planning mechanisms for water resources, water quality, capital maintenance and investment, and resilience and emergency planning.

5.5.3 Adaptation Plan

The Climate Change Adaptation Action Plan must support sustainability principles and be viable in a low carbon economy. The Plan will also be subject to monitoring and review.