

Introduction

In February 2013 a Natural Flood Management (NFM) practitioner's workshop took place in Edinburgh (for more details see Holstead and Wilkinson, 2013). Some participants noted that the legislation surrounding reservoirs had acted as a significant barrier to the construction of large earth bund storage ponds in Pickering, England in 2011- 2013.

This briefing is informed by a literature review and consultation with practitioners from the "Slowing the Flow at Pickering" NFM project (forestry.gov.uk/fr/slowingtheflow) regarding their experience of the legislation and how it impacted upon implementation. It aims to inform policy makers about the situation in Pickering and highlight barriers to the implementation of NFM in Scotland, in light of the Reservoir (Scotland) Act 2011.

Background

The Reservoirs Act 1975 was amended by the Flood and Water Management Act 2010 and in Scotland, the Reservoirs (Scotland) Act 2011. Currently all three Acts are providing legislation for reservoir construction, inspection and supervision. The Flood and Water Management Act and Reservoirs (Scotland) Act are awaiting secondary legislation to fully implement all relevant sections for reservoirs.

In England, Scotland and Wales these Acts create a framework for the construction and management of reservoirs to reduce the risk of an uncontrolled release of water from reservoirs and the consequences of subsequent flooding. While the Reservoirs Act set the minimum capacity for a controlled reservoir at 25,000 m³, the new legislation makes provision to reduce it to 10,000 m³.

According to the Flood and Water Management Act 2010 (S 33) in England and Wales a reservoir is considered to be:

- A large, raised structure designed or used for collecting and storing water, and;
- A large, raised lake or other area capable of storing water which was created or enlarged by artificial means.

According to the Reservoirs (Scotland) Act 2011 a reservoir is considered to be:

- (a) A structure designed or used for collecting and storing water;
- (b) An artificial (or partly artificial) loch or other artificial (or partly artificial) area.

A combination of more than one of the structures or areas noted in (a) and (b) is to be treated as a controlled reservoir where none of the individual structures or areas is a controlled reservoir under that subsection but where;

- Water does (or could) flow between them, and
- There could be an uncontrolled release of 10,000m³ or more of water from the combination.

Accumulation features in the Flood and Water Management Act 2010. It notes: '*...the Minister shall aim to ensure that a structure or area is treated as large under the regulations only if 10,000 or more cubic metres of water might be released as a result of the proximity or communication*' (S33).

Pickering Slowing the Flow

The Pickering "Slowing the Flow" NFM project is led by Forest Research with Forestry Commission England, Environment Agency, North York Moors National Park Authority, Durham University, Natural England and involvement from the wider community. The lead funder is Defra.

One aspect of the project was to design and build two earth embankment defences to protect 60 properties in Pickering during low level floods. The scheme was designed to store up to 85,000m³ of water and estimated to cost £950,000¹. This estimate was based on a low risk (Category C) reservoir. As the design progressed the Reservoir Panel Engineer, using personal judgement, assessed the construction as being a high risk Category A reservoir because if the bund were to fail, it would be of potential risk for some Newbridge residents (a downstream hamlet). The flood storage scheme being proposed was aiming to mitigate a 1 in 25 year flood event. However, the engineer stipulated the specification was increased to withstand a 1 in 10,000 year event due to the risk it posed as a reservoir. The requirements this placed on the design, coupled with the constraints of the site, resulted in a revised cost estimate for a single large raised reservoir of £3.2m, tripling the cost of the project. It should be noted that the reservoir would only store water infrequently (once or

¹ For more information see

[www.forestry.gov.uk/pdf/Pickering_Bunded_Storage_Update_August2010.pdf/\\$file/Pickering_Bunded_Storage_Update_August2010.pdf](http://www.forestry.gov.uk/pdf/Pickering_Bunded_Storage_Update_August2010.pdf/$file/Pickering_Bunded_Storage_Update_August2010.pdf)

twice a year) for a short period of time.

A larger number of smaller schemes were considered, giving exemption from the legislation. Investigations suggested smaller flood storage areas in conjunction with other measures may be cost effective and provide the required level of flood protection². Such schemes are in line with NFM owing to softer engineering. However, smaller bunds would still be classified as a reservoir because of the potential cumulative effect in cascade. If this option was taken, each small bund would have to be designed to a higher specification; making it more expensive than one large bund. Work by Quinn et al. (2013)³ has shown how using a pond network model, a series of 30 small 550m³ storage ponds can decrease flood peaks. If these were larger or closer together with the potential to cascade, the Flood and Water Management Act 2010 requirements could impact on the design of such features. Subsequently, the project team decided to develop the larger flood storage option at a higher than original cost.

Owing to the changes resulting from the engineer's decision (to classify as a category A (risk to life), and their professional judgement on the construction requirements necessary to minimise risk, the design of the Pickering scheme resembles a traditional small reservoir engineering project rather than a NFM measure. The proposed bund could be over 2m high and concrete will be used, meaning that it falls out of the remit of NFM and becomes a traditional engineering approach.

Policy Implications

From this research, a number of key messages have arisen:

- 1. Potential capacity changes** - The Reservoirs Act 1975 classifies a reservoir as a structure or area capable of holding 25,000 m³ or more of water. The new legislation (Flood and Water Management Act 2010 and the Reservoirs (Scotland) Act 2011) makes provision for this to be reduced to 10,000m³. The changes to the volume have not yet been confirmed by the Government in England. In Scotland the reduction in volume will not be implemented until 2016/17 at the earliest. Secondary legislation will be required.
- 2. Legislative inconsistencies** - The stipulations of the Water Management Act 2010 have shown in this case, to be counter intuitive to the development of larger NFM features. The Act has moved from the size-based approach of the Reservoirs Act 1975 to a risk based approach. While not fully enacted, many engineers are following the new Act. The Pickering NFM project was classified by the project engineer as a reservoir and thus subject to the stipulations of the law. The risk classification of the storage bund was assessed on professional judgement to be a category A owing to risk of an uncontrolled release which could affect a hamlet and railway line downstream. Consequently, the engineer requested an increased specification for the bund (to minimise the risk), to counteract a 1 in 10,000 year event, tripling costs. The increased specification required (in this case) by the risk-based approach means that features may become engineered, and thus less resemble natural flood features. This is inconsistent with legislation such as the Flood Risk Management (Scotland) Act 2009 which aims to move towards sustainable flood management and away from engineered features.
- 3. Cascade issues** – The construction of a series of smaller storage features (such as interception ponds or offline flood storage ponds) could command a higher risk category due to the combined storage volume of the network of features (i.e. if one were to fail the flood wave could, depending on design, cascade downstream). The spacing of the features and the size and number of feature is site specific and therefore can only be judged in the planning phase. NFM features will be captured where an uncontrolled release of 10,000m³ could occur. This does not necessarily relate to capacity, rather the potential amount which can be released.
- 4. Balanced consideration of risk** – Large NFM features such as bunds that offer a low level of flood protection (e.g. 1 in 25 years), if classified as a reservoir may be increased in specification depending on their risk classification (as determined by the appointed engineer). To minimise risk, they may be required to withstand a 1 in 10,000 year event increasing the engineered nature of the features.

Research Team, Contacts and Resources

Wilkinson, M and Holstead, K.L (2013) UK and Ireland natural flood management practitioners' workshop, CD2012/23. Available at www.crew.ac.uk/publications Contact: Mark Wilkinson (Mark.wilkinson@hutton.ac.uk)

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² See [http://www.forestry.gov.uk/pdf/Pickering_Briefing_Update_Oct_2012.pdf/\\$FILE/Pickering_Briefing_Update_Oct_2012.pdf](http://www.forestry.gov.uk/pdf/Pickering_Briefing_Update_Oct_2012.pdf/$FILE/Pickering_Briefing_Update_Oct_2012.pdf).

³ See <http://research.ncl.ac.uk/proactive/belford/newcastlenfmrafreport/>