Factsheet

Reservoir Safety and Operation

How we will safely design and operate the proposed new reservoir

The Legal Framework for Reservoir Safety in England

Construction, operation, maintenance and modification of large reservoirs in England and Wales must be carried out in compliance with the Reservoirs Act 1975 (the Act) as amended by the Water Act 2003 and Schedule 4 (Reservoirs) of the Flood and Water Management Act 2010 .

The Act, along with its associated secondary legislation and guidance, is constantly reviewed and refined by the UK government to ensure it remains fit for purpose. The South East Strategic Reservoir Option (SESRO) is sufficiently large for the Act to apply to it.

The Act provides the legal framework for ensuring reservoir safety and does the following:

- Requires the design, construction and initial operation of new reservoirs to be undertaken under the supervision of a competent engineer who is already appointed to a panel of such engineers by the UK government.
- Requires the regular surveillance and operation data gathering of existing reservoirs and the continuous appointment of a competent engineer to supervise its performance in terms of reservoir safety.
- Requires periodical independent inspection of reservoirs by a competent engineer who can recommend investigation be done or modifications made to maintain reservoir safety, which must be completed within the timeframe stipulated.
- Empowers enforcement authorities (which is the Environment Agency in England) to enforce compliance with its standards and imposes penalties on reservoir owners who fail to meet their legal obligations.

The Act is supplemented by several regulations which provide further detail on reservoir safety. There is also supplementary guidance for managing specific technical aspects of reservoir design and operation, such as managing floods, seismic risk and drawdown capacity. General guidance to reservoir owners (and operators) on how to comply with these legislative requirements can be found on the government website: www.gov.uk/guidance/reservoirs-owner-and-operator-requirements

Designing the reservoir

Design Supervision

In relation to the design and construction of new reservoirs, the Act requires design and construction to be supervised by an appointed 'Construction Engineer'. To hold this appointment, the engineer must be highly experienced and have already been appointed to an appropriate panel of reservoir engineers. In the case of SESRO being a 'non-impounding' reservoir (i.e. one not blocking a natural flow of water with a dam or embankment), the engineer must have been appointed either to the "All Reservoir" Panel or the "Non- impounding" Panel. Appointments to these panels are made by the Secretary of State (of the Department of Environment, Food and Rural Affairs) following applications vetted by the Reservoirs Committee, a committee of the Institution of Civil Engineers which assists the Secretary of State in this duty. The threshold of competence for such panel appointments is very high, reflected in the small number and extensive experience of those engineers on the panels.

A Preliminary Design for SESRO was developed in 2005–2008, and a Construction Engineer was appointed by Thames Water to supervise that design work during that period. Since that time, in support of Thames Water's Water Resource Management Plans and in support of regulatory submissions made by Thames Water in relation to SESRO, the Preliminary Design has been reviewed, and the embankment dam design subject to minor adjustment. This work has been carried out under supervision of an All Reservoir Panel Engineer. A Construction Engineer has been appointed and is overseeing the design work underpinning the preparation and submission of the application for development consent, as well as subsequent design development, trials and then construction.

For large new reservoir and dam projects, international best practice advocates the establishment of a board or panel of specialists to review key elements relevant to design and construction. This is also reflected in current UK Guidance under the Act, and provides further supervision to that of the Construction Engineer. Such a 'Reservoir Advisory Panel' (or "RAP") has been set up for SESRO and they review ongoing investigations, trials and design analyses.

Design Details

The design for SESRO follows international best practice for embankment dams, to ensure the highest possible standard of dam safety is met. Some of the key design features include:

- Monitoring and surveillance – a comprehensive, automated system of instruments will be installed within the dam, as part of an overall monitoring strategy to identify untoward movement or leakage. Alerts raised through the system will lead to appropriate response as per Thames Water's established and proven reservoir safety management system, which already operates at its other reservoir sites. Such readings will supplement on-site monitoring by operatives trained in reservoir safety surveillance.

- Provision of 1 metre per day (m/day) emergency drawdown – it is now typical for large reservoirs in the UK to have permanently installed facilities to lower the water level in the reservoir if any concerning signs of structural distress are identified at the dam. The SESRO design includes pipework with sufficient hydraulic capacity to draw the reservoir down at a rate of 1m/day from maximum operating level, which is the maximum recommended rate within current UK guidance, and which matches that adopted at all other Thames Water reservoirs.

- A wide embankment crest and prohibition on uncontrolled vehicular access – limiting the risks of damage induced by persons.

- Provision to prevent overfilling – in common with many other Thames Water reservoirs which are filled by pumping from adjacent rivers, SESRO will have a comprehensive control system to prevent overfilling.

- Wave erosion protection – the entire inner face of the embankment will be protected from wave erosion capable of protecting against extreme storm winds.

In addition to the inclusion of these design features and others, the safety of SESRO would also be enhanced by its fully bunded arrangement. Most reservoirs in the UK are impounded by a dam across a watercourse, so rain falling within the natural catchment upstream of the reservoir is directed through it. Such reservoirs need to handle large inflows during extreme storm events within their catchments. In the case of SESRO, as the reservoir is fully bunded, the only inflow during an extreme storm relates to precipitation directly onto the reservoir surface, which is accounted for in the design.

Management of Reservoir Safety at Existing Reservoirs

Thames Water owns and operates 59 reservoirs which fall within the remit of the Reservoirs Act 1975, and Thames Water is fully compliant with the Act. As stipulated by the Act, reservoir owners (and operators) are required to manage existing reservoirs safely. Thames Water has long established processes for routine surveillance, operation, monitoring and maintenance by qualified trained staff. Thames Water has a highly experienced Reservoir Safety Management team that oversees the inspection process under the Act and ensure the reservoirs are operated and maintained safely. Each existing reservoir has a Supervising Panel Engineer continuously appointed under the Act who is responsible for raising concerns regarding the safety of the reservoir and gives advice to improve safety of the reservoir. The Supervising Panel Engineers produce an annual statement on the condition of the reservoir and actions taken within the year which is issued to Thames Water and the Environment Agency.

On a periodic basis (up to every 10 years) every reservoir is inspected by a suitably qualified independent engineer. These engineers can instruct investigations or modifications for safety which must be done within a certain timescale. Completion of these works would be enforced by the Environment Agency.

Maintenance

Regular maintenance at reservoirs is important to enable monitoring of the integrity of the main body of the reservoir structure and to repair any damage which occurs over time. Maintenance of supporting infrastructure such as the drawdown system and monitoring equipment is also required and routinely completed.

General site management includes activities such as managing grass and vegetation, sediment removal from drains, ditches, and conveyance systems, maintaining footpaths, roadways, signage, fencing and safety barriers.

Data Gathering and Surveillance

Reservoir operators gather data on reservoir performance to help manage reservoir safety and track performance against expectations. For an embankment dam such as that proposed for SESRO, key monitoring data during operation consists of drainage flows, water pressures at points within the dam, settlement and movement, along with water levels and weather data. Where possible, data is collected remotely and through automated monitoring, with readings validated through on-site physical inspection by trained operatives. As noted above, Thames Water has extensive experience and an excellent track record of doing this for its reservoirs.

Emergency Preparedness and Dam Break Analysis

Reservoir owners (and operators) must have emergency response plans in place to deal with any potential incidents including those which could lead to a breach of the dam.

The probability of such a breach occurring at SESRO is extremely remote, given its fully bunded arrangement, the inclusion of the design features noted above, and the supervision of its design, construction and operation.

Reservoir dam break analysis is an assessment of the potential consequences of a breach or failure of the reservoir structure and the potential risk to areas around the reservoir site. Dam break analysis involves modelling using specialised software to simulate the flow paths and therefore the consequences of a breach of the dam. These models consider factors such as reservoir water volume and dam characteristics to determine the breach flow, and downstream topography to determine areas of inundation. The results of the modelling are used to inform emergency response.

The emergency response plan would be prepared ahead of the first filling of the reservoir as required by the Reservoirs Act 1975.