Using existing water supply reservoirs in Scotland for flood alleviation

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Costești–Stânca dam, River Prut

Lake area: 70 km$^2$
Flood storage volume > 500 Mm$^3$
SW dams and reservoirs

SW has about 240 reservoirs

About 170 reservoirs currently operational

Total volume stored about 440 Mm$^3$

Reservoirs sizes:

- < 50,000 m$^3$ to 64 Mm$^3$ (Megget)
- Loch Lomond 129 Mm$^3$
- Average 1.8 Mm$^3$
The project

Objective: To explore opportunities for using SW reservoirs for downstream flood alleviation

SW approached by communities after December 2015 floods

Phase 1: Identify reservoirs with flood alleviation potential (completed in March 2017)

Phase 2: Detailed assessment of flood alleviation opportunities

Data from Scottish Water and SEPA
Water supply reservoir: schematic diagram

River inflow

Maximum design water level for water supply

Dam crest level

Spillway crest level

Controlled outlet

Minimum design water level

Design water supply volume

River outflow

NOT TO SCALE
Potential changes for flood alleviation (1)

Volume (or ‘space’) created for flood management

Maximum design water level for water supply lowered

Changes to spillway required

Design water supply volume

Minimum design water level

May need to modify outlet structures

NOT TO SCALE
Potential changes for flood alleviation (2)

Volume (or ‘space’) created for flood management

Maximum design water level raised

Design water supply volume

Minimum design water level

Dam crest level

Controlled outlet

Changes required to dam and spillway

May need to modify outlet structures

NOT TO SCALE
Potential changes for flood alleviation (3)

Volume (or ‘space’) created for flood management

Maximum design water level raised

Maximal design water level for water supply lowered

Minimum design water level

May need to modify outlet structures

Changes required to dam and spillway

NOT TO SCALE

River inflow

Design water supply volume

Dam crest level

Controlled outlet

River outflow

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Phase 1: Screen reservoirs for detailed analysis in Phase 2

Criteria:

- Reservoir upstream of FRA?
- Location of the reservoir within the catchment
- Significant impact on flood flows in the FRAs
- Scope for allocating reservoir volume for floods
- Magnitude of potential benefits

FRA: Flood Risk Area
Phase 1 findings

About 35 reservoirs could provide flood alleviation to high risk areas.

About 10 reservoirs recommended for detailed analysis in Phase 2.

Phase 2 selection to be reviewed by Scottish Water and partners.
Modelling to assess flood reduction benefits:
- Minimum works
- Other options

Use of OPTIONISE

Operating rules that balance:
- Flood alleviation
- Water supply reliability
- Water level drawdown rate (for dam safety)
- Other operating requirements (e.g. water level constraints)

Benefits and costs of options
Use of three non-operational reservoirs for flood alleviation

Reservoirs cover part (but not all) of the catchment: other measures needed

Reservoirs handed over to the City Council

Space created by lowering water levels (using notches in spillway crests)
Selkirk Flood Protection Scheme: St Mary’s Loch

Space created for flood storage: 2.6 Mm$^3$

Benefit-cost ratio about 25
Thank you