SEPA
Scottish Environment Protection Agency
Buidheann Dìon Àrainneachd na h-Alba

Reservoir Risk Designations: Guidance on representations and reviews

Reservoirs (Scotland) Act 2011

Every day SEPA works to protect and enhance Scotland's environment, helping communities and businesses thrive within the resources of our planet.

We call this One Planet Prosperity

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http://contactscotland-bsl.org/

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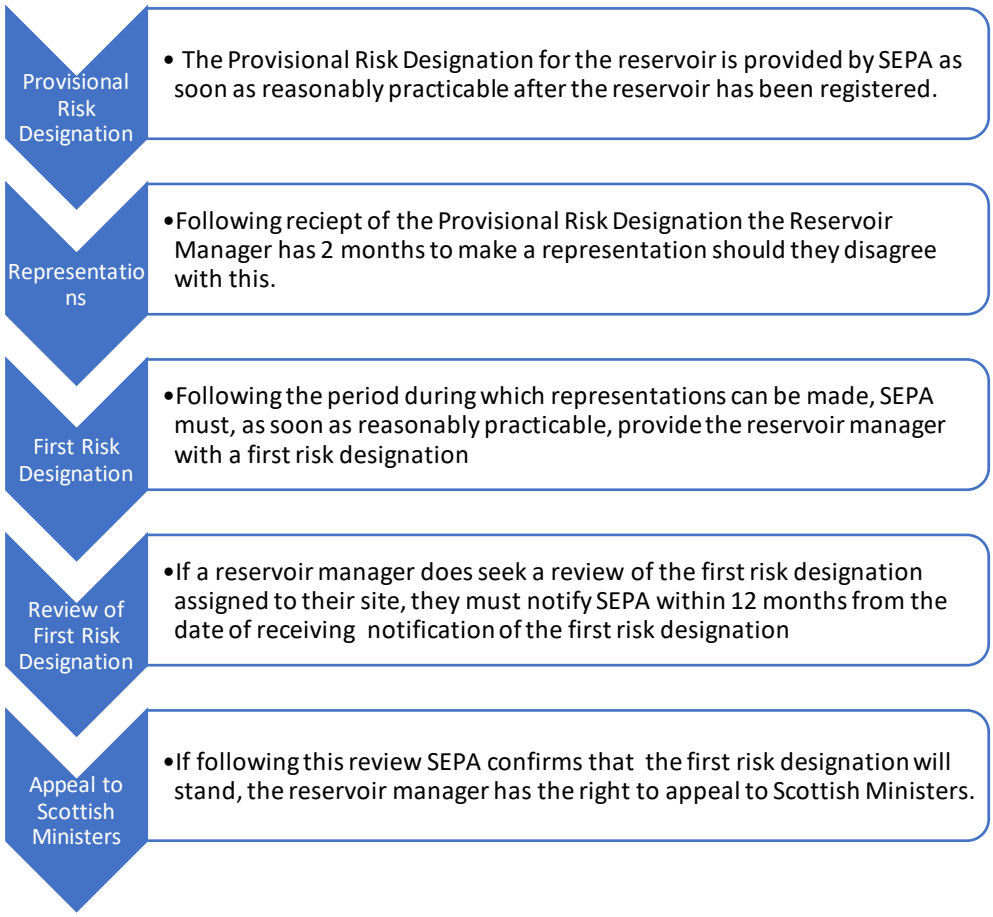
1 Introduction

Reservoir safety in Scotland is governed by the Reservoirs (Scotland) Act 2011 (the Act). The Act requires that all controlled reservoirs are registered with SEPA and provides a risk-based framework which requires SEPA to assign a risk designation to all controlled reservoirs, and review these at least every 6 years.

Section 22 of the Act lays out the aspects that SEPA must consider when undertaking the risk designation process, these being the potential adverse consequences and the probability of an uncontrolled release of water.

An overview of SEPA's approach to assigning risk designations is outlined in SEPA's Risk Designation briefing note which can be found on the SEPA website. There are a number of steps to assigning a first risk designation in order to ensure that any change in circumstance and the views of interested parties can be considered. These steps are detailed in SEPA's Guidance on Reservoir Risk Designation document (available on the SEPA website) and are summarised below:



1. Provisional risk designation

• SEPA provides reservoir managers with a provisional risk designation as soon as is reasonably practicable after their site has been registered.

• Reservoir managers may make a representation to SEPA within 2 months of receiving the provisional risk designation should they disagree with it.

2. First risk designation

• Following the end of the two-month period during which representations can be made, SEPA must, as soon as reasonably practicable, provide the reservoir manager with a first risk designation.

• As part of this process SEPA will also outline the process for a review of the first risk designation should a reservoir manager be dissatisfied with the outcome of any representations made. Reservoir managers can also request a review of a first risk designation even if they chose not to submit a representation.

• It should be noted that there is a fee for seeking a review.

3. First risk designation review process

- If a reservoir manager does seek a review of the first risk designation assigned to their site, they must notify SEPA within 12 months from the date of receiving notification of the first risk designation.

- If following this review SEPA confirms that the first risk designation will stand, it will also provide reservoir managers with information on the right to appeal to Scottish Ministers.

- If SEPA provides a lower risk designation than originally assigned, it will refund the associated fee for undertaking the review process.

It is important that SEPA and reservoir managers have a shared understanding of risk designation and the process by which reservoir managers can make representations or apply for a review of a first risk designation.

This guidance outlines how reservoir managers may best make representations or submit information in support of a review of a first risk designation if required. It covers both the types of supporting information required to enable a change to be fully considered and how amendments to risk designations will be made (where appropriate).

SEPA will not be inclined to accept representations or to review a first risk designation in situations where the information supplied merely disputes either SEPA's Reservoir Inundation Mapping Methodology or SEPA's Risk Designation Outline Methodology.

In addition, SEPA will not be inclined to accept representations or review first risk designations where it is clear that the information provided will not result in a change to the reservoirs overall risk designation. Further information on the requirements to enable a representation for change or a review of a first risk designation to be considered is outlined in Section 4.

2 Supply of provisional and first risk designations

Prior to the issuing of any risk designation, a process of registration and validation is undertaken; the timescale of which can vary according to the characteristics of the reservoir.

Following this SEPA will provide the reservoir manager with a provisional risk designation summary sheet for each identified breach scenario which provides information on the provisional risk designation for each of their reservoirs for which the associated inundation map has been published.

At the end of the two-month period during which representations can be made, SEPA will, as soon as is reasonably practicable, provide the reservoir manager with a first risk designation. At this point a first risk designation summary sheet for each identified breach scenario will be supplied. The risk designation summary sheets will be issued by post to the main reservoir manager contact.

3 The representation and first risk designation review process

SEPA has undertaken a thorough review of the risk designation outputs to ensure that the methodology for assigning risk designations has been applied correctly. Those reservoirs which are designated as 'High risk' due to impacts to only one receptor category other than Human Health (e.g. Transport) have undergone a further review to assess whether this designation should stand.

The next stage in working towards agreeing a first risk designation is to determine if reservoir managers are broadly satisfied with their risk designations and to assess any representations or first risk designation reviews that may be requested. The risk designation representation and first risk designation review processes provide:

- An opportunity to identify, at particular locations, where there is concern that the risk designation outputs may be significantly different to the reservoir managers understanding of the likely impacts of reservoir flooding from an uncontrolled release of water.
- An opportunity to submit information to SEPA that supports the reservoir managers understanding of the likely impacts of flooding from an uncontrolled release of water at a particular location.

4 Requesting risk designation amendments

Appendix A (Model Acceptance Criteria) sets out in detail what information may be supplied to SEPA to support risk designation representations or to enable a review of a first risk designation.

Any additional information provided will be fully considered by SEPA to determine whether the information warrants a change to the risk designation.

We will liaise with reservoir managers to discuss the outcome of any representations or first risk designation reviews. Information supplied will be retained and used as input for future development of the risk designation process.

SEPA will be guided by the following seven principles when considering information supplied from reservoir managers in support of an amendment:

1. **Methodology disputes**: SEPA will not be inclined to accept representations or to review a first risk designation when the information supplied merely disputes either SEPA's Reservoir Inundation Mapping Methodology or SEPA's Risk Designation Outline Methodology. These methodologies have already been the subject of consultation with the wider UK reservoir industry.

2. **Minor changes to impacted receptors**: SEPA will not be inclined to accept representations or to review of a first risk designation where it is obvious that the information provided will only change the detail of the risk designation (e.g. number of properties inundated) but will not result in a change to the overall risk designation of the reservoir.

3**. Improved reservoir inundation modelling output:** SEPA will be inclined to accept representations where improved reservoir inundation modelling outputs are provided. Specifically, modifications to flood extents and re-runs of inundation models and risk designations on the basis of improved model output from compatible model products. Note that any modifications or re-runs of inundation models will only be undertaken where it is clear that an alteration to the flood extent is likely to result in a change to the overall risk designation.

4. **Appropriate supporting information:** SEPA will be inclined to accept a representation where appropriate supporting information is provided. Any statements (as a request for amendment) should be made with supporting evidence, such as photographs.

5. **Technical errors in the application of the methodology:** SEPA will be inclined to accept a representation where there has been technical errors in the application of the Methodology. Specifically, when: information is provided that indicates an incorrect application of either the SEPA risk designation or inundation mapping methodologies. For example, where it can be demonstrated that the predicted flood path, escapable volume or impact on receptors downstream is materially incorrect.

6. **Application of improved topographic information:** SEPA will be inclined to accept a representation where improved topographic information is provided. Specifically, when there is provision of improved topographic information / data which justifies the re-run of the models used to develop the strategic reservoir inundation maps.

7. **Extent information from other modelling approaches:** SEPA will be inclined to accept a representation where extent information from other modelling approaches is provided. Outputs from detailed modelling studies may be used to support verification of the reservoir inundation modelling outputs.

5 Completion of supporting information forms

SEPA has produced both a Provisional Risk Designation Representation Form and a Risk Designation Review Application Form to accompany this guidance. These forms can be found on the SEPA website and provide an opportunity for the reservoir manager to submit any information that might support an amendment to the reservoir inundation map and associated risk designation outcome.

Section 2 should be completed for each submission of data the reservoir manager is making to support a request for modification to the risk designation output. Effectively, the form should act as a cover sheet for the data such that it identifies how the data affects the risk designation output developed by SEPA.

For example, a copy of the form with Section 2 completed should be provided for each of the following situations:

- A hydraulic model of a particular dam breach scenario.
- A ground model.
- A more detailed hydrological dataset.
- An area that has been identified as being incorrectly mapped.
- An area where the risk designation outputs are significantly different to the reservoir mangers understanding of the likely impacts of reservoir flooding from an uncontrolled release of water.

6 How SEPA will respond to amendment requests

SEPA will seek to ensure that any representations or applications to review first risk designations that comply with both the guidance in Appendix A and which are supported by the relevant information are utilised for a change in risk designation to be considered.

As noted in Appendix A, there are three potential avenues to progress a representation request:

- Implement direct changes to the inundation mapping outputs and associated risk designation.
- Initiate re-runs of the models used in the reservoir inundation mapping exercise (where it is clear that modification of the inundation map is likely to change the overall risk designation of the reservoir).
- Use of information such as photographs or modelled flood extents to verify the maps and risk designations.

SEPA will review the information provided by the reservoir manager and will liaise with them prior to making changes. This may initiate further discussion to progress the submission.

Following the end of the two month representation period SEPA will issue the 'First' risk designation to reservoir managers. This 'First' risk designation will have taken account of any representations that were made within the statutory time period. SEPA will respond to the reservoir manager in question with a determination for each submission and will outline how the information supplied was used to assess the representation

SEPA appreciates the support of reservoir managers in verifying the risk designation outputs. All information supplied will, as a minimum, aid the verification of the risk designation outputs.

Where modelled output is available that is similar to the strategic SEPA assessment then such submissions will be implemented within the current reservoir inundation map production cycle.

However, there may be particular, unique, situations which would only warrant inclusion in future mapping cycles.

Contact us

Any questions relating to the review of risk designation outputs can be emailed to us at Reservoirs@sepa.org.uk or you can speak to the Reservoirs Regulatory Unit by calling the SEPA Contact Centre on 03000 996699 and asking for the Reservoir Regulatory Unit.

Appendix A: Model acceptance criteria

A.1 Direct Changes:

Definition: More detailed information (including flood extents, modelling results etc) which are able to be directly incorporated into the reservoir inundation maps and risk designation assessment in those instances where it is clear that such a change will result in a change to the overall risk designation.

A1.1 Principle 3 – Compatible modelling output

Direct changes will be considered where similar model products and scale of assessment are demonstrated. Specifically, when using a similar strategic 2D modelling approach as applied to producing the Scotland wide reservoir inundation maps.

An inundation model and associated risk designation revision request may be based on the following hydrological variations:

- New hydrological conditions (data revisions or changes in physical conditions).
- Improved hydrological analysis methods.
- Correction of errors in the hydrological analysis performed; or
- Alternative (validated) sources of hydrological data.

A revision request may also be based on the following hydraulic variations:

- New hydraulic analysis (reflecting data revisions or changes in physical conditions).

  Improved hydraulic analysis methods.
- A correction of errors in the hydraulic analysis performed.

Please ensure that you contact SEPA prior to submitting any reservoir inundation modelling outputs / data or supporting information such as hard copy maps.

This is to ensure that protectively marked information (such as reservoir inundation modelling outputs) is handled and transferred to SEPA in accordance with the National Protocol for the Handling, Transmission and Storage of Reservoir Information and Flood Maps and associated documents, for Scotland.

General requirements

If direct changes are to be made to the risk designation based on the supply of improved reservoir inundation modelling outputs, the **minimum** requirement is the provision of appropriate information on flood extent, flood depth, flow velocity, flood hazard score and initial and peak flood arrival time information.

Flood extent information alone from other model types will be considered in the verification of the reservoir inundation maps and risk designation outputs but will not result in a direct change.

Any hydrological / hydraulic model data files relevant to the change request must be provided, including the provision of full non-commercial data licensing, to enable SEPA to use (i.e. re-model) and share model files and derived hazard map outputs.

For direct changes to be applied the following criteria apply:

- The flood extent, depth, velocity, hazard and initial and peak flood arrival time outputs should be a continuous unbroken outline.
- The flood extent, depth, velocity, hazard and initial and peak flood arrival time outputs should be submitted in ESRI (i.e. ArcGIS) shapefiles or ESRI raster grids that are compatible with ArcGIS version 10.0.
- All false blockages have been identified and removed within the study area.

In addition, similar modelling software, to that utilised in the development of the national reservoir inundation maps, is required with evidence that:

- The software used has been thoroughly peer reviewed or extensively tested through an extended period of use by several different organisations.

The Environment Agency has carried out benchmarking tests of 1D and 2D hydraulic modelling packages commonly used in the UK and advice should be sought from SEPA if the suggested software is not covered by the Environment Agency Benchmarking.[1]

- The analyses have been carried out by reservoir managers based on a better quality topographic[2] and hydrological input data than that used by SEPA.

- Analysis account for the effects of natural physical changes that have occurred in the floodplain.

- The files must be geo-referenced to a known projection such as British National Grid and know datum such as mAOD.

- Demonstration that the model has been verified and passed appropriate quality checks. For example the model should met an agreed measure of stability (such as a +/- 1% mass balance error.

- Any negative depth values (representing 'dry' areas) are removed from the grid.

The differences in modelled flood depth between SEPA's reservoir inundation maps and those supplied in support of representations are +/-0.15m.

Software Specific Requirements

As noted above, advice should be sought from SEPA in those instances where the software packages used to develop reservoir inundation maps is not covered by the Environment Agency benchmarking.

[1] Crowder, R., Pepper, A., Whitlow, C., Sleigh, A., Wright, N., & Tomlin, C. (2004). Benchmarking of Hydraulic River Modelling Software Packages R&D Technical Report W5-105/TR0. Bristol: Environment Agency.

Neelz, S., & Pender, G. (2013). Benchmarking the latest generation of 2D hydraulic modelling packages. Bristol: Environment Agency.

[2] Topographic data is considered of better quality if it is of greater vertical accuracy, is more recent than that used to prepare the national reservoir flood hazard outputs and meets SEPA's standards for topographic data. Requests for change must be in line with the scale and display resolution of the final, national product (5m resolution). Higher resolution data are also acceptable

Modelling software packages that will be considered suitable to the development of reservoir inundation maps include:

- InfoWorks ICM
- InfoWorks RS (2D)
- TUFLOW
- MIKE 21
- ISIS-2D
- Flood Modeller Pro
- JFLOW +

A.1.2 Principle 4 – Appropriate supporting information

Appropriate information must accompany flood extent data to enable the consideration of inundation model and / or risk designation re-runs. SEPA may undertake limited remodelling if extent information is supplied with supporting information to confirm the requirement for change, for example, hydrology information or the impact of restrictive structures, etc.

General Requirements

Hydrological Variation

To allow consideration of the revision request on the grounds of hydrological variation, SEPA will require the following from the reservoir manager:

- A statement of confidence in support of new hydrological information.
- Data to support the use of the new hydrology.
- An outline of the major changes expected to the flood modelling outputs that would result from the use of new hydrology.
- The hydraulic analysis and revised outlines related to the hydrological analysis.

Since the hydrological revision for reservoir maps will have a significant impact on the scope of a mapping revision request, only significant changes are considered:

- Significant variation between the proposed values and the mean value used in the modelling (i.e. large standard deviations will justify modifications).
- Change greater than 0.15m in water surface due to change in hydrology

Hydraulic Modelling Variation

To allow consideration of the revision request on hydraulic modelling grounds, SEPA will require the following from the reservoir manager:

- Hydraulic method used for the revision.
- Software used for the revision
- Method used for representation of buildings
- Method used for representation of surface roughness.

A certified document (map) should be submitted showing the following information as applicable:

- The maximum extent of flood.
- The maximum velocity.
- The maximum depth.
- The maximum hazard scores.
- The initial flood arrival time
- The peak flood arrival time
- Assessment of model confidence with regard to information used and produced from an investigation (e.g. lower resolution ground models, greater use of estimated information in lieu of recorded figures).

A.1.3 Principle 5 – Technical errors in application of methodology

Direct changes may be considered where technical errors in the application of the methodology are identified based on the reservoir managers understanding of the likely impacts of flooding from reservoirs at a particular location.

General Requirements

General requirements include:

- Identification of a technical or scientific error.
- Demonstration that the methodology used was not applied correctly. For example where it canbe demonstrated that the identification of a flood path is materially incorrect.

Identification of any visible and logical errors (e.g. incorrect boundaries in inundation extent caused by 'false' structures).

- If there are technical errors in the construction of the model (e.g. the presence of significant false blockages).

A.2 Model re-runs

Definition: More detailed information which justifies the re-run of the models used to develop the strategic reservoir inundation maps.

A.2.1 Principle 6 – Application of improved topographic data

General Requirements

A revision on the basis of topographic dataset variation shall be completed when datasets are identified as available other than those used in the current strategic reservoir inundation maps.

Ground model information can be improved by the incorporation of local, site specific surveys undertaken by dedicated survey contractors. It would be necessary to determine, and have available for scrutiny, the level of accuracy that could be afforded to the data proposed for modification justification.

Most readily identifiable structures have been removed during the modelling work to produce the reservoir inundation maps. The location of any remaining structures should be identified, highlighted and passed to SEPA for consideration. Technical details such as the geometry and makeup of the structure are not required.

It should be noted that the extent of the 'alternative' topographic dataset will be a key consideration as to whether it is viable for incorporation into a more extensive dataset. It may not be appropriate to re-run a strategic hazard mapping model on the basis of an alternative dataset that covers a particularly small area.

The threshold for acceptability would vary depending on the context of the dataset; rural / low risk areas are less likely to introduce a significant variation in the mapped inundation extents and therefore the modification of a ground model is **less likely** to be taken forward. Conversely, small areas in an urban context may be **more likely** to justify the incorporation of the alternative ground model into that used for the reservoir inundation maps. The outcome could be significant in that flood extents, water depths, flow velocities and hazard scores may change and with that the risk designation for a particular reservoir.

A.3 Other Modelled Output

Definition: More detailed information which is able to be used to verify the strategic flood hazard maps.

A.3.1 Principle 7 - Extent information from other modelling approaches

Extent information from other modelling approaches remains important and valuable. These might differ from approaches applied in the reservoir inundation map development but have value nonetheless and can be used in the verification of flood extents.

General Requirements

The following information would be used:

- Water depth, extent or velocity information from other model types or hydrological/hydraulic analysis based on alternative methodology (1D/2D etc.) might be considered in the verification of reservoir inundation extents but will not result in a direct change.
- While often limited in respect of reservoirs, any historical flood event information, if available, would be of use.

Contact Information:

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