Culverting of main rivers

Position statement

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Document Owner: Head of Business, Flood Risk

What is this document about?

This document outlines our position on culverting watercourses and the reasons for this. It also outlines considerations that should be applied when culverting is the only option.

Who is this document for?

This document is for Natural Resources Wales (NRW) staff and external organisations, including the public

Contact for queries and feedback

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Version History

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Our position on culverting main rivers

This position on culverting applies to main rivers only. When considering a culvert on an ordinary watercourse, please contact the relevant Lead Local Flood Authority (LLFA), or the relevant Integrated Engineering team in NRW in relation to ordinary watercourses in Internal Drainage Districts (IDDs).

We are fundamentally opposed to the culverting of watercourses because of the adverse impacts on flood risk, natural river processes, ecology and human safety. In line with the Sustainable Management of Natural Resources (SMNR) it is important to maintain open watercourses to retain and improve the quality and resilience of our ecosystems.

We are also fundamentally opposed to any proposal to build over existing culverts on main rivers due to flood risk, health and safety considerations, increased maintenance costs and difficulties to undertake works and/or future improvements. This would also preclude future options to restore the watercourse back to an open channel. We encourage the restoration of culverted watercourses to open channels wherever possible for flood risk, pollution prevention and ecological purposes by restoring a more natural river form and functioning river environment within urban and rural locations.

Background

Watercourses are an integral feature of our landscape and provide a wealth of ecosystem services including drinking water, management of flood risk, recreation, ecosystem connectivity and a wealth of biodiversity.

The Flood and Water Management Act 2010 defines a culvert as "*a covered channel or pipe which prevents the obstruction of a watercourse or drainage path by an artificial construction*". Culverting can exacerbate the risks of flooding and increase maintenance requirements and costs. It also disconnects ecosystems, hinders natural processes, destroys wildlife habitats, damages an attractive natural amenity and interrupts the continuity of the linear corridor of a watercourse. Detrimental effects are likely to include:

- increased likelihood of flooding due to obstruction of flow and risk of blockages, and loss of floodwater storage leading to increased impact of flooding
- loss of and adverse effects on natural morphology, fisheries and wildlife habitat including substrate
- the creation of barriers to fish passage through increased water velocities, shallow depths and eroded culvert entrances
- increased riverbank and bed erosion downstream of culverted sections
- greater difficulties in providing for drainage connections
- increased liabilities and costs due to the need to maintain, repair and replace culverts
- increased health and safety hazards, notably for workers clearing blockages and for children in urban areas
- locally reduced groundwater recharge
- increased difficulty in detecting the origins of pollution and in monitoring water quality

Exceptions

We recognise there are situations where culverting may be the only reasonably practicable option, such as short lengths for access purposes or where highways cross watercourses.

However, culverting must not be considered until all other options have been explored with justifiable reasons why such options are not feasible. Preferred options include:

- open span bridges
- revision of site layout to retain an open watercourse.

Where culverting is proposed, applicants will be required to fully demonstrate why it is both necessary and the only reasonable alternative. Any application must include information to show that it will not have a detrimental effect on flood risk, pollution, and the environment.

Culverting of watercourses has the potential to impact on the hydro-morphology of the river. Any proposal for a new culvert (irrespective of length) will need to be supported by a suitable Water Framework Directive (WFD) Assessment, which should be carried out early on in the design process in order to ensure that the proposal does not unacceptably affect the WFD status of the river.

A Flood Consequences Assessment (FCA) may be required to demonstrate that the consequences of flooding are acceptable i.e., does not increase flooding elsewhere.

The culvert length should be restricted to an absolute minimum and the application must demonstrate that appropriate mitigation measures can be put in place to reduce any adverse effects.

In all cases where culverting is considered to be the only practicable option, applicants or landowners must accept sole ownership and responsibility for future maintenance.

Permit and consenting requirements

Any proposal to construct a new culvert, or to alter an existing culvert on a main river, or to erect any structure over or within 8 metres of a culverted main river will require a prior Flood Risk Activity Permit (FRAP) from us, under the Environmental Permitting Regulations (England and Wales) 2016.

Where the proposed culverting works are situated on an ordinary watercourse, the prior consent of the relevant LLFA may be needed. LLFA's may have their own policy on culverting which should be referred to and we would suggest contacting the relevant authority for further information, or the relevant Integrated Engineering team in NRW in relation to ordinary watercourses in Internal Drainage Districts (IDDs).

It is a criminal offence to complete any flood risk activity without an environmental permit issued by us and we may therefore consider undertaking enforcement action if we become aware of any unpermitted works.

We recommend that you contact your Development and Flood Risk (DFR) team at the earliest opportunity to discuss your proposal and any permitting requirements.

We will consider each application to culvert a watercourse on its merits and in accordance with our risk-based ways of working. We will only approve an application if there is no reasonable alternative, and the application fully demonstrates no adverse impact on flood risk and the environment.

A similar approach would be taken for any proposal considered at the planning stage. We will not support a planning application which proposes new culverts unless all reasonable alternatives have been considered, and the application demonstrates minimal adverse impact on flood risk and the environment. We would also not support any planning application which proposes to erect a structure over or within 8 metres of a culverted main river.

We must also consider the key aims of the Water Framework Directive (England & Wales) Regulations 2017, the Conservation of Habitats and Species Regulations (2017) and the Environment Act (Wales) 2016, including the SMNR, throughout the permitting process.

Considerations for culvert design

Where a culvert is deemed to be acceptable, the design should follow the principles outlined below. More information and guidance can be found in CIRIA C786: Culvert, screen and outfall manual. The design principles in CIRIA C786 should be followed, including the specific matrix risk/assessment for screen design.

Detailed design plans will be needed to support a planning and/or FRAP application. The applicant must consider the environmental implications of all options for the proposed works to determine the least environmentally damaging solution in line with SMNR. Additionally, where possible, environmental enhancements should be considered to mitigate for any negative impacts.

Design considerations include (but are not limited to) the following:

- the proposed culvert length should be as short as possible and retain a natural river bed.
- any design must not restrict flood flows and must ensure that the required hydraulic capacity can be accommodated above the riverbed level. This will include no surcharge above the soffit (top) of the culvert for the design event which may include consideration of culvert blockage.
- the use of differing sizes or shaped pipes/conduits must be avoided
- multiple culvert arrangements must be avoided.
- appropriate inlet and outlet structures should be provided to ensure smooth hydraulic transition and to avoid erosion and deposition at these locations.
- headwall arrangements at either end should be in line with existing bank profiles and appropriate to the local environment.
- movement of sediment, any culvert blockage and ongoing maintenance requirements must be considered by either the landowner or culvert owner.
- any inlet or outlet screens should comply with latest CIRIA guidance.
- the culvert gradient should be set to the same as that occurring naturally.
- permanent culverts should not be set onto bedrock.
- any future access for inspection or maintenance (including Emergency response) must be considered within the design.

- the minimum recommended culvert size will vary according to the size of the watercourse but culverts smaller than a 450 mm diameter pipe or equivalent are particularly prone to blockage and their use should be avoided.
- for long culverts under embankments or similar structures, culverts with at least 1,050 mm of headroom above finished bed level should be used to facilitate access for inspection and maintenance.
- it is also recommended to bury the inlet and the culvert invert at least 150 mm below the existing natural bed of the watercourse to allow a natural bed to form within the invert. This should allow a continuous bed to form throughout the affected length of watercourse. The depth of burial will depend on site specific circumstances.
- culvert sizing should permit the continued free movement of mammals.
- the invert level at the outlet to the culvert above the existing natural bed must not result in a sudden change in level which would pose an obstruction to fish passage and alteration to the geomorphology of the watercourse.
- culvert design should ensure the continued free and unobstructed movement of fish, eels, mammals and sediment through the structure.

In all cases we recommend culverts should be oversized to prevent hydraulic restrictions and to maximise flood capacity and conveyance.

Contact

For any questions relating to culvert design principles, permitting requirements or environmental considerations, please contact your local Development Flood Risk team:

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