

Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters

2016



**GUIDELINES ON PROTECTION OF FISHERIES DURING
CONSTRUCTION WORKS IN AND ADJACENT TO WATERS**

INLAND FISHERIES IRELAND

2016

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1. INTRODUCTION.

1.1 Inland Fisheries Ireland (IFI) is responsible for the protection, management and conservation of the inland fisheries resource in Ireland, which includes over 70,000 kilometres of rivers and streams and 144,000 hectares of lakes. The agency is also responsible for sea angling. The waters concerned contain a wide range of fish species, which are particularly sensitive in terms of threats to their physical habitat and to water quality such as arise during construction works in and adjacent to waters.

1.2 IFI policy is aimed at maintaining a sustainable fisheries resource through preserving the productive capacity of fish habitat by avoiding habitat loss, and harmful alteration to habitat. Construction works particularly those entailing the installation of new river and stream crossing structures and the realignment of river channels have the potential to significantly impact both in the short and long term on fisheries resources if they are not carried out in an environmentally sensitive manner.



A brown trout at the alevin stage shortly after hatching. This life stage is very sensitive to pollution and physical disturbance.

1.3 These guidelines identify the main issues of concern in terms of construction impacts and their prevention. They set out *inter alia* requirements in relation to bridges and culverts and the need for such structures to allow for unhindered upstream and downstream movement of fish and aquatic life.

2 OBLIGATIONS ON DEVELOPERS DESIGNERS AND CONTRACTORS TO CONSULT IFI.

2.1 Contact should be made with IFI at the earliest possible stage in the planning and design process where works such as road construction, installation of culverts and bridges, the crossing of rivers/streams with pipelines and works on and in the environs of waters are planned. Such consultation will enable those concerned to comply with the provisions of the Fisheries Acts and Habitats Regulations.

2.2 In addition to the general guidance and requirements detailed herein, there will be design and construction issues specific to individual projects and locations. In such cases IFI will issue detailed operational and construction requirements.

3. THE ISSUES OF CONCERN.

3.1 Damage to the Aquatic and Associated Riparian Habitat, e.g.

- Removal and loss of instream spawning gravels and larger stones.

- Loss of submerged and emergent aquatic vegetation.
- Loss or damage to bankside cover including removal of trees, shrubs and bankside root masses.
- Undesirable changes in watercourse morphology and hydrology.



Drip tray is undersized, dangerously positioned and leaking oil. Unacceptable practice.

3.2 Pollution of Waters.

Pollutant	Examples of Construction Source
Silts and solids.	Earthworks, new drainage networks and instream works.
Cementitious residues.	Bridge, culvert and drainage headwall construction, etc.
Oils and greases. Anti freeze.	Construction plant and equipment.
Wood preservative.	Treatment of new timber fencing.

3.3 Introduction of Non Native Species.

Invasive Species	Construction Source
Plants, algae, fish and shellfish.	Earthmoving equipment, pumps, boats, ropes etc, previously used perhaps unknowingly in waters containing invasive species.
Plants and algae.	Imported materials such as top soil.

Further information on invasive species their impact and control, and on bio-security is available at www.inlandfisheriesireland.ie



It is a serious offence to discharge deleterious matter such as oil contaminated residues to waters.

3.4 Interference with Upstream and Downstream Movement of Aquatic Life.

- Improperly designed or installed temporary and/or permanent watercourse crossing structures. For example, insufficient water depth in culverts, culverts with perched inlets, outfalls and excessive slope.

- Insufficient water depth over bridge aprons/scour slabs.
- Physical alteration of stream channels resulting in:
 - Altered hydraulic characteristics.
 - Changes in stream profile, particularly in width, depth, gradient and current speed.



Temporary crossing impassable to fish life.

4. TIMING OF INSTREAM WORKS.

4.1 There are significant variations in the timing and duration of salmonid (Salmon and Trout) spawning activity throughout the Republic of Ireland. To minimise adverse impacts on the fisheries resource works in rivers, streams, watercourses, lakes, reservoirs and ponds should normally (except in exceptional circumstances and with the agreement of IFI) be carried out during the period July-September.

4.2 The appropriate 'window' for instream works can vary depending on the nature of the fishery resource concerned and the existence of other factors such as catchment or sub catchment specific Bye Laws and Regulations.

5. TEMPORARY CROSSING STRUCTURES ON WATERS.

5.1 All watercourses which have to be traversed during construction projects should be effectively bridged prior to commencement of works. There is sometimes a serious misconception that in installing temporary crossing structures, the only issue is keeping water flowing from above a temporary crossing to below it. Design and choice of temporary crossing structures must provide for passage of fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over wintering areas, as well as preventing erosion and sedimentation. In certain circumstances, access for angling or commercial fishing purposes may also be required.



Temporary crossing structure. Impassable for aquatic life and emitting silt to waters as construction equipment traverses the crossing. Unacceptable practice.

5.2 No temporary crossing on any watercourse shall be installed without the approval of IFI as regards sizing, location, duration and timing.



The same temporary crossing location as shown on the previous page, but with a laden dumper dislodging and causing loss of cover material to waters.



Temporary clear span 'bailey bridge' ensuring free upstream and downstream movement of aquatic life. The streamside fencing should be 5 metres from the watercourse, not immediately alongside as in this photograph.



The inevitable result from the crossing shown above. Continuous silt discharges. Unacceptable practice.



A clear span temporary crossing capable of carrying heavy axle loadings and long wheel base vehicles.

5.3 The preferred option is for clear span 'bridge type' structures on fisheries waters.

5.4 The crossing of watercourses at natural fords is not permitted because of the amount of uncontrolled sedimentation that can be generated.

5.5 The creation of fords on streams and rivers through the introduction of stone is prohibited.

5.6 Where circumstances such as space or access difficulties preclude use of clear span structures, temporary crossings structures shall:

5.6.1 Comprise one or more metal or concrete pipes, prefabricated culverts or such other material as IFI may permit of minimum diameter 900 mm. Pipes or culverts may be vertically stacked.

5.6.2 Be laid in such manner as to maintain the existing stream profile.

5.6.3 Ensure no significant alteration in current speed or hydraulic characteristics, in particular not result in scouring, deposition or erosion upstream or downstream the temporary crossing location.

5.6.4 Have capacity to convey the full range of flows including flood flows likely to be encountered without the crossing being overtopped.

5.6.5 Be covered with clean inert material such as to allow for the safe crossing of the widest items of plant and equipment without cover material being dislodged and entering waters.

5.7 The approach and departure routes to temporary crossing structures should be designed and installed so that drainage will fall away from the watercourse being crossed. In the event that the fall of ground does not permit sufficient control on drainage, additional earthworks settlement areas shall be provided.

5.8 Temporary crossing structures should be fenced with terram or similar material to prevent wind blow carrying dusts and other potentially polluting matter to waters.

5.9 Side armour (e.g. reinforced concrete traffic barriers) should be provided on temporary crossing structures to ensure machinery cannot drive over its edge, or force the discharge of material from the bridge deck to waters.

5.10 IFI wish to emphasise that site selection for temporary crossings should have regard to all access and construction needs ranging from those of fencing contractors vehicles to the longest wheelbase of multi-axle cranes.



A crossing structure over a designated salmonid water. Note: terram covered fencing, reinforced concrete traffic barriers and fall back from the watercourse.

5.11 It is not permissible, except in exceptional circumstances, to reposition temporary crossing structures where these are not of a clear span type.

6. RIVER AND STREAM PERMANENT CROSSING STRUCTURES.



Is the culvert adequately sized?

6.1 Structures should not damage fish habitat or create blockages to fish and macroinvertebrate passage. Design and choice of structure should be based on its technical

and economic feasibility to pass fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and overwintering areas, provision in certain areas of angling and commercial fishing access including boat access and prevention of erosion and sedimentation.

6.2 Culverts are the most frequently used river/stream crossing structures and are associated with some of the most common fish passage problems. The culverting of long stretches of fisheries water is extremely undesirable and can result in significant loss of valuable habitat. In the case of crossing structures over fishery waters, the preferred position is for clear span structures (bridges), so as not to interfere in any way with the bed or bank of the watercourses in question.



Excessively wide culverts can result in reduced current speed, ponding, and siltation of instream gravels.

6.3 Bridge foundations should be designed and positioned at least 2.5 metres from the river bank so as not to impact on the riparian habitat.



Excessively long culvert resulting in habitat loss and reduced productivity due to inadequate light penetration.

6.4 Generally, bridges and bottomless culverts are the best option for maintaining natural stream channel characteristics and have the least impact on habitat. However, because of design and load bearing considerations, bottomless culverts may not always be suitable for installation particularly on narrow river channels, as foundations may encroach on the channel itself and possibly result in future scouring or erosion.

6.5 Taking account of recent advances and investigations in the area of climate change and flood studies, designs should be such as to verifiably have carrying capacity for a 1 in 100 year fluvial flood flow whilst maintaining a minimum freeboard of 300 mm.

6.6 The Office of Public Works (OPW) is the lead agency for flood risk management in the Republic of Ireland. Design and capacity of structures must also be in accordance with their requirements. IFI strongly recommends that contact be made with OPW at the earliest stage in the planning and design process. (www.opw.ie)



An embedded box culvert sized to match existing stream profile.

6.7 Clear span designs maintain channel profile, do not alter gradients, readily pass sediment and debris and provide unrestricted passage for all size classes of fish by retaining the natural stream bed and gradient. Water velocity is not changed and they can be designed to maintain the normal stream width. Foundations should be positioned at least 2.5 metres from waters.

6.8 Embedded box and pipe culverts are less preferable to bridges and bottomless culverts. Embedded culverts must maintain the natural channel gradient, width and substrate configuration. They should be buried to a minimum of 500 mm. below the stream bed at the natural gradient. Box and pipe culverts must be sized to maintain the natural stream channel width. The gradient should not exceed 3%. The availability of suitably sized material (depending on hydraulic conditions) to initiate "simulation" of the stream bed is the most preferable approach to establish fish and faunal passage through culverts.

6.9 Culverts should be positioned where the watercourse is straightest and aligned with its bed.



Off-line culvert at construction stage back filled with gravel. The size range and depth of fill required will be site specific.

6.10 In the case of bridges and bottomless culverts, structures should be designed and installed so as to:

- 6.10.1 Allow for the maintenance of channel profile and existing gradient.
- 6.10.2 Be capable of passing such debris as might arise during flood flow conditions.
- 6.10.3 Ensure adequate light penetration to minimise loss in primary productivity.
- 6.10.4 Not result in damage to the riparian habitat or necessitate construction within 2.5 metres of waters.
- 6.10.5 Provide at locations specified by IFI, angling access and/or access for commercial fishing purposes.



Box culvert positioned at incorrect level. Upstream fish passage is made difficult. Culvert invert should be 500 mm. below existing bed level and back filled with clean gravel to match the existing stream profile.

6.11 While the preferred option is for bottomless culverts, IFI is prepared in certain circumstances to consider proposals for the installation of box or pipe culverts on fisheries waters. These may be installed subject to structures being sized so as to meet the requirements at 6.10 in terms of channel profile, gradient, flood debris capacity, light, access and:

6.11.1 Be positioned such that both the upstream and downstream invert shall be 500 mm. below the upstream and downstream river bed invert levels respectively.

6.11.2 Never exceed a slope of 5%, in which circumstances baffles generally are required, and preferably not exceed a slope of 3%. As baffles can reduce the hydraulic efficiency of culverts, appropriate capacity provision must be included in the overall design.

6.11.3 In the case of box culverts on angling waters, be 3 meters in height.



The smooth concrete finish is totally unsuitable for fish passage.

6.12 Pipe culverts are not generally considered acceptable on fisheries waters. They are normally only appropriate for use on minor watercourses and drainage ditches where these can be demonstrated as not being significant in terms of fisheries habitat.



Unacceptable culverting practice. These pipes are totally impassable to fish.

6.13 Bank protection works are often required upstream and downstream of new structures, to ensure no undercutting or destabilisation of either the structure or riparian bank areas occurs. In carrying out bank protection works, it is essential that large enough boulders are selected and strategically positioned, to ensure they cannot be undercut. Normally this entails part burying boulders up to one third of their depth below stream bed

level and securing them into their final position. In areas of high water energy, to ensure stability, boulders size should be a minimum of 0.5 ton.



The boulders in these bank protection works are not large enough, not sunken below stream bed level and likely to be undercut and dislodged in a storm event.



Suitably sized rock armour built to high water level at a location influenced by tidal back-up.

6.14 To facilitate revegetation, each course of boulders laid should be back filled with a layer of top soil. Selection of boulders in terms of shape to facilitate their placement and stability is a major consideration. Irregularly shaped boulders are very difficult to work with in terms of building multiple stable courses.



Revegetation of rock armour facilitated by the placing of locally sourced topsoil (to ensure no importation of non local grasses and shrubs) between each layer or course of boulders at installation time.

6.15 The height to which rock armour is built must take account not only of the riparian zone requiring protection, but also in certain circumstances of the need to protect e.g. kingfisher and sand martin habitat. In many instances, one or two layers of armour will be sufficient to protect and stabilise the toe of embankments while allowing nesting.



Visually unsightly stone filled gabion baskets.

6.16 Gabions are not a preferred option when it comes to bank protection. They can easily be vandalised and once the mesh is cut or broken, baskets can collapse. Gabion baskets can be unsightly and it is difficult to successfully

establish and maintain vegetation on side walls. Gabion baskets are normally only acceptable at locations where due to access constraints it is not possible to install rock armour.

7. CONSTRUCTION IMPACTS.

7.1 Uncured concrete can kill fish, plant life and macroinvertebrates by altering the pH of the water. Pre-cast concrete should be used whenever possible, to eliminate the risk to all forms of aquatic life.

7.2 Discharge of silt-laden waters to fisheries streams is of particular concern. Silt can clog fish spawning beds and juvenile fish species are particularly sensitive. Plant and macroinvertebrate communities can literally be blanketed over, and this can lead to loss or degradation of valuable habitat. It is important to incorporate best practices into construction methods to minimise discharges of silt/suspended solids to waters.



Silt discharge minimisation by providing retention areas to reduce discharge velocity and allow settlement during rainfall events.

7.3 Discharges of fuels and oils can be directly toxic to aquatic life and at sub lethal levels lead to tainting of fish tissues, rendering fish inedible. Oil films on water can seriously interfere with the diffusion of oxygen from the atmosphere into waters and in extreme cases result in oxygen depletion.



Construction sites require careful management. Is this the optimal haul route in terms of impact minimisation?



The practical impact of poor silt control.

7.4 IFI require that:

7.4.1 When cast-in-place concrete is required, all work must be done in the dry and effectively isolated from any flowing water (or water that may enter streams

and rivers) for a period sufficient to ensure no leachate from the concrete.



Silt control pond. The blue hose conveying pumped silt laden waters has its outlet securely anchored within the stone aggregate thereby dissipating energy, minimising disturbance, and preventing pond contents being disturbed and re-suspended.



Silt control pond. Note hose conveying pumped silt laden waters with its outlet positioned within the gravel mound thus ensuring no disturbance of pond contents.



Poor work practice. The drip tray is undersized, constructed of too light a material, and accordingly overly flexible, easily damaged, and unlikely to retain oil residues.

7.4.2 No direct discharges be made to waters where there is potential for cement or residues in discharges.

7.4.3 Designated impermeable cement washout areas must be provided.

7.4.4 The pH of any and all discharges made from and during construction works shall be in the range 6.0 - 9.0 units and not

alter the pH of any receiving fisheries waters by more than +/- 0.5 pH units.

7.4.5 Silt traps/settlement ponds or other forms of containment and treatment shall be constructed at locations that will intercept run-off to streams. Traps shall not be constructed immediately adjacent to natural watercourses. A buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact. Alternatively, imported materials such as terram, straw bales, coarse to fine gravel should be used either separately or in combination as appropriate to remove suspended matter from discharges.

7.4.6 The level of suspended solids in any discharges to fisheries waters as a consequence of construction works shall not exceed 25 mg/l, nor result in the deposition of silts on gravels or any element of the aquatic flora or fauna.

7.4.7 All oils and fuels shall be stored in secure bunded areas and care and attention taken during refuelling and maintenance operations. Particular

attention shall be paid to gradient and ground conditions which could increase the risk of discharge to waters.

7.4.8 Temporary oil interceptor facilities shall be installed and maintained where site works involve the discharge of drainage water to receiving rivers and streams.

7.4.9 There shall be no visible oil film in any discharges from construction works to waters.

7.4.10 That all containment and treatment facilities are regularly inspected and maintained.

7.4.11 Waterproofing and other chemical treatment to structures in close proximity to waters shall be applied by hand.

7.4.12 Hydroseeding shall not be carried out in close proximity to water. These areas shall be seeded by hand.



Terram lined (to prevent erosion) silt control pond outlet channel showing gravel acting as filter medium for silt removal.

8. DUST SUPPRESSION AND WATER ABSTRACTION.

8.1 It is accepted in the interests of protection of terrestrial ecosystems and so as to avoid a wide range of impacts on

persons and property, that dust control measures sometimes may be required. This is normally achieved by abstraction from watercourses adjacent to the site of earthworks. In such circumstances it is essential that the aquatic resource is protected and that over-abstraction does not take place especially in low flow summer conditions at locations supporting important fish populations.



Continuous abstraction using submersible pump. No screening in place to prevent the entry of e.g. juvenile fish species to the pump. Unacceptable practice.

8.2 IFI require that:

8.2.1 Water abstraction for dust suppression shall not take place from any water body containing or suspected to contain aquatic invasive species.

8.2.2 Abstraction is confined to only those larger waters identified and agreed as being of sufficient size and volume so as to allow abstraction without adverse impact.

8.2.3 Abstraction points shall be screened so as to ensure that fish and aquatic plants are not removed from waters in the abstraction process.



A screened abstraction point using terram fitted over a fabricated support frame.

9. PLANNING, DESIGN AND CONSTRUCTION ISSUES.

9.1 The preferred position from the fisheries perspective is for clear span river and stream crossing structures thereby allowing for installation/construction without the need to alter or move existing watercourses. In the case of bridges and bottomless culverts, designers should ensure proposals are such that foundations and abutments including wing walls can be constructed without entering on or damaging the riparian zone, or existing channel profile.

9.2 Where on-line construction is proposed or taking place, it may be necessary for IFI, following an assessment of on the ground conditions with the contractors involved, to temporarily remove using electro-fishing equipment, fish from the reaches involved.

9.3 Where on line box or pipe culvert construction is proposed, it will be necessary to install a temporary by-pass channel so as to allow for stream continuity and the normal upstream and downstream movement of fish and aquatic life depending on location and seasonality.

9.4 Temporary long term by-pass channels shall be excavated and sized such as to replicate existing upstream and downstream channel conditions as regards width, depth, gradient and instream materials. Where necessary, rock armouring will be provided. In terms of capacity, by-pass channels shall be sized so as to accommodate such flood event as might reasonably be expected based on examination of hydrometric data and catchment characteristics.

9.5 In newly constructed by-pass channels the process of diverting waters and associated movement of fish stocks may only take place under the direction and supervision of IFI or its agents. Adequate advance notice of all such proposed works shall be given to IFI.



Extreme meanders installed during excavation of a new channel to overcome excessive gradient between the original course of the stream (in the background at tree line) and the point of entry of the newly created channel to a culvert (in foreground under the timber fencing). In this instance there was inadequate provision at the planning and design stage for the necessary land take.

9.6 Where temporary short term by-pass channels are required for a number of days, these shall be excavated and sized such as to accommodate such flood event as might reasonably be expected over the period in question.

9.7 Where a structure installed on line is completed within the period during which instream works normally may be undertaken (July-September), flow may be re-established through the new structure, fish transferred from the temporary by-pass channel back to the original channel, and the by-pass decommissioned immediately on completion of the fish removal with the area levelled and landscaped as appropriate. Such works may only take place following the giving of advance notice to IFI and under its supervision.

9.8 Where a structure installed on line is not completed within the period during which instream works normally may be undertaken, flow may not except in exceptional circumstances be re-established through the new structure until the next approved 'window' for such instream works.

9.9 Where on-line construction is not feasible and a structure is constructed off-line (subject to IFI approval), the course of the existing stream can be altered and new approach/departure channels designed and installed to link into the original stream channel

9.10 IFI require where box and/or pipe culverts are installed off-line on fisheries waters that:

9.10.1 Particular attention shall be given by designers and contractors to survey pre-existing upstream and downstream stream bed levels at appropriate locations, taking account of the requirement to ensure newly installed box or pipe culverts are lain with their invert level 500 mm. below bed level, so that in overall terms the newly created section of stream shall replicate and

where appropriate, improve on that which it replaces.

9.10.2 The approach and departure channels for newly installed culverts shall be excavated and sized such as to replicate and be compatible with existing upstream and downstream channel conditions as regards width, depth, gradient and instream materials. Bends and meanders shall be incorporated into the new channel.

9.10.3 The approach and departure channels for newly installed culverts are back filled to a depth of up to 500 mm with clean round gravel in such size range as required where IFI determine that the material in the newly formed channel is unsuitable in terms of fish habitat.

9.11 Where as an exceptional measure consequent on limited land availability or other space constraints a culvert having a gradient greater than 5% is permitted, IFI require as follows:

9.11.1 Water velocity through the culvert should not exceed 1.2m/sec. in the case of salmonid habitat and 0.8 m/sec. in the case of cyprinid habitat.

9.11.2 Baffles should be provided within the culvert structure to locally reduce flow velocity thus aiding fish swimming upstream without undue stress.

9.11.3 The entry and exit points of the structure must be drowned out to a minimum depth of 150 mm. in the case of salmon waters and 100 mm. for trout waters.

9.11.4 Where culvert gradient is too steep to achieve backwatering, the downstream water level should be raised by providing one or more ponding weirs below the culvert outfall. Ponding weirs should have fish notches to facilitate upstream movement and the pools formed by them should provide resting and take-off conditions for fish.

9.12 The fitting of mesh or screens to culverts, albeit with the intention of intercepting instream debris is prohibited.

9.13 Newly constructed river and stream channels shall have banks battered to a finished angle of not greater than 45° on one bank and not greater than 30° on the opposite bank, (to allow for maintenance of a low flow channel, an overflow and a flood flow channel). Banks shall be top soiled and seeded so as to ensure the growth and development of a broad range of local grasses and shrubs thereby facilitating development of stable bank root structures.



Well vegetated newly established river channel, with broadleaves planted to within 5 meters of the overflow channel. The root structures aid bankside stability.



Looking from upstream towards a culvert arrangement. Moderate and flood flows are conveyed in the right hand culvert. Entry to that culvert is dictated by the invert and contour of the right hand portion of the newly created river channel. The left hand bank finished batter angle is approx. 45°. The first portion of the right hand bank to convey the moderate flow is battered to approx. 30°. The extreme right bank area is battered to approx. 45° to convey flood flows.

9.14 Broadleaves shall, where prescribed by IFI, be planted along newly created channels so as to provide a mixture of dapple and shade conditions. Planting shall be a minimum of 5 meters from the watercourse channel.

9.15 In the case of culverts, low flows can be accommodated in an appropriately sized structure, thereby sustaining the fisheries resource. Moderate and flood flows should be directed through a culvert that becomes operable only at a pre-determined discharge level. Moderate and flood flow culverts should be installed such that the culvert empties in its entirety when the flood has passed.

9.16 To aid in the colonisation and development of newly created river channels, it is desirable to transfer established riparian plants, shrubs and trees together with living root structures as well as boulders, stones and gravels from decommissioned to new channels where they can be positioned, inserted and replanted as appropriate.



Newly created channel. The riparian grasses on the right bank have been transferred from the previous course of the now redundant original channel. The root structures stabilise the bank area while the grasses provide a degree of cover and shade and provide habitat for aquatic insects which form part of the food for fish.

9.17 In the case of newly created stream and river channels IFI require that:

9.17.1 Such transfer of riparian plants, trees and instream material(s) as necessary, is carried out under IFI's direct supervision.

9.17.2 Gravels and stones are removed from the dried out river channels and securely stored for re-use in the newly created river channels.

9.18 Stock proof and mammal proof fencing shall not cause an obstruction to fish passage or angling.

9.19 IFI shall be reimbursed the cost of fish removal and replacement operations associated with river and stream diversions and associated works.

10.0 REPAIRS TO EXISTING BRIDGES, CULVERTS AND SCOUR SLABS.

10.1 There are within Ireland very many old stone bridges in need of strengthening and

repair works. The most commonly used methods for such works include pressure grouting, guniting and pointing of joints



Grout loss to waters is normally stopped by placing dry cement over the leak, with sand bags on top to restrict grout flow until the leak solidifies. (This photograph was taken after water flow was re-established following solidification of the grout.)

10.2 The concerns as regards sensitivity of aquatic life to pollutants and physical disturbance set out earlier in this document all apply, particularly as regards loss of grout and gunite rebound, both of which are highly alkaline.



Repairs to a single arch bridge and scour slab with stream flow piped from upstream to downstream (foreground) during both grouting and slab repair.

10.3 Grouting is a high risk process, as it is not always possible to pre-determine the route that grout will follow. It may travel through

fissures and appear upstream or downstream of the structures under repair, sometimes metres from the location of injection. Particular vigilance is required. During grout injection at least one member of a repair crew should be closely monitoring for grout losses both upstream and downstream of the structure. Portable pH monitoring facilities should always be available and staff trained in its use.

10.4 Where the structure to be grouted comprises a number of arches, water flow should be diverted away from the arch being repaired so as to allow working in the dry. Diversion of water by means of temporary damming should be undertaken. Sand bags in conjunction with e.g. plastic sheeting, marine plywood and other suitable materials may be used. A number of manufacturers provide heavy duty rubber type aqua dams which can readily be deployed, linked together and filled on site with river water thus forming a very effective seal to a bunded area. While such damming and diversion of water as is required will normally be only for a short period, the dam or berm must nonetheless be high enough not to be over topped in the event of a rainfall event and increased water levels.

10.5 Where a single arch structure is under repair, to achieve grouting in the dry, water may be diverted from upstream to downstream by means of a secure flume arrangement, or through piping, or in very limited circumstances, by means of over pumping. Screening to preclude entry of aquatic life to pumps must be carried out.



Gunite rebound on a stream bed where no precautions were taken to prevent its entry to waters. Rebound having a pH >11.5 would have entered the actively flowing stream with dire environmental consequences.

10.6 In all instances of guniting and repair works including repointing and masonry cleaning, the entirety of the area of water over which works are taking place should be protected from gunite rebound, mortar and vegetation loss by installation of a sealed and secure decking which shall extend upstream and downstream the structure concerned so as to ensure no losses to water.



Apron/scour slab inaccessible on its downstream end to fish life because of the extent of perching and impassable due to a combination of excessive water velocity and lack of water depth across its surface.

10.7 Approved forms of scaffolding are required to support decking. It is essential that

the decking completely captures all falling debris and rebound. All materials captured must be removed for safe disposal.

10.8 Repairs to bridge aprons/scour slabs must be undertaken so as to ensure upstream and downstream passage of fish is possible in all flow conditions. Particular care must be exercised to ensure perching does not result where new concrete slabs are poured.



Low level stone weirs installed on a salmonid nursery stream to back water the bridge apron /scour slab originally installed at too high a level.

10.9 Existing stream bed materials (stones and boulders depending on conditions) should be set into new concrete aprons/slabs thereby providing for non uniform baffled flow of varying depth across the structure which will allow for the weakest fish species to swim upstream through the deeper water area.

10.10 Scour slabs should be dished so as to provide a deeper zone and consequently deeper water to facilitate fish passage.

10.11 It is difficult and costly to retrospectively render a poorly installed apron/scour slab passable, especially where it has been installed at too high a level. In some instances the installation of one or more low level weir type structures in the river downstream may assist in

back-flooding the apron thereby rendering it passable.

10.12 The installation of baffles can assist where excessive water velocity over an apron/scour slab prohibits free upstream fish movement. Baffles should be positioned so as to reduce velocity and provide temporary rest areas for weaker fish attempting to swim upstream.



Large stone baffles held in position on concrete apron with stainless steel dowel rods drilled into both the apron and stones. (Poor placement of the livestock fencing as shown in the photograph has the potential to cause blockage by catching debris.)

11.0 PIPELINE INSTALLATION.

11.1 In the case of pipeline crossings under fisheries waters, the preferred method is by way of trenchless crossings using techniques such as horizontal directional drilling, auger boring or micro-tunnelling. There are many advantages from use of such methods. Apart from the obvious avoidance of impacts on the fisheries resource, works do not have to be confined to the July-September 'window' period.

11.2 Where circumstances such as site size and contour or the existence of buildings

preclude trenchless methodologies, open cut or trench type crossings may be undertaken.

11.3 In the case of trenchless crossing of waters IFI require as follows:

11.3.1 Locations for drill rig positioning and pipeline pull areas shall be chosen or engineered such that the fall is away from the waters in question, thereby facilitating installation of pollution containment and control facilities.

11.3.2 Where drilling fluids are being returned for cleaning and re-use or recirculation through a temporary fluid return line, pneumatic leak testing shall be carried out to confirm the integrity of the return line.

11.3.3 Where circumstances necessitate the running of a return fluid line across the bed of the waters being under bored, the pipeline shall be sunken and weighted down by means of prefabricated concrete collars or by sand bags attached using web construction straps, or such other means as appropriate and securely anchored. Marker buoys and on-land marker posts will be required and all such fluid return pipelines and markers shall not interfere with or constitute a fouling risk to licensed and legally used fishing equipment.

11.3.4 Spent drilling fluids including separated drill materials shall be contained in secure bunded areas for off-site disposal at a licensed disposal facility.

11.4 In the case of open cut or trench type crossing of waters IFI require as follows:

11.4.1 Water shall be diverted from upstream to downstream the pipeline crossing location by means of a secure open flume arrangement, or through piping, or in limited circumstances, by means of over pumping.

11.4.2 Screening to preclude entry to pumps of aquatic life must be carried out.

11.4.3 The waters being crossed shall be effectively dammed both upstream and downstream of the trench location so as to ensure that works are undertaken in the dry.

11.4.4 Where concrete ballast is used to prevent pipelines rising as a result of buoyancy, it should be precast.

11.4.5 Following completion of backfilling, river bed and banks shall be reformed to match their original profile.

11.5 It will normally be necessary to temporarily remove, using electrofishing equipment, fish from the reaches involved.

12. ANGLING AND COMMERCIAL FISHING ACCESS.

12.1 In circumstances where crossings of important angling waters are concerned, it will often be necessary to provide for angling access to and from stretches of water during the construction phase of projects. It is important to note that fishing rights are property rights and that it is a legal right for anglers to access fisheries. Additionally, certain commercial fishing activities may have entry and access requirements. In such site specific circumstances, IFI will issue project and location specific requirements.



A tidal water with access for vehicles and on the opposite side, access for anglers.

12.2 IFI require:

12.2.1 In the case of permanent crossing structures on waters recognised as of angling importance, that a minimum walkway through or under the structure 1.5 meters in width and 2.5 meters in height be provided. The walkway shall be self draining and have a non slip finish.

12.2.2 In the case of a bridge spanning a specific salmon angling site, up to 7 meters clearance above water level and in the case of trout angling, up to 4 metres clearance to allow casting.

13.0 PROVISION OF DOCUMENTS.

13.1 In the case of structures and pipelines crossing waters, IFI shall be provided in Excel spreadsheet format with precise details of all watercourse crossings including seasonal streams. The spreadsheet shall in respect of each watercourse contain:

13.1.1 The number, code or other means of identification of the location.

13.1.2 Easting and northing coordinates (Irish Grid Ref).

13.1.3 Dimensions including width, height, length and gradient of proposed structures and the estimated discharge.

13.1.4 A description of the proposed structure including its shape.

13.2 Contractors/developers shall provide or have provided to IFI:

13.2.1 In the case of road construction, a copy of the Discovery 1:50,000 map(s) showing the proposed road scheme.

13.2.2 In the case of road construction, engineering drawings and OS maps in A3 size showing mainline and side road plans, chainage and profiles for all locations where watercourse crossings and drainage issues arise.

13.2.3 Engineering drawings and OS maps in A3 size of all crossing structures and pipelines in final proposal stage for construction. These shall include dimensions, setting out points, and where necessary gradient expressed as a percentage.

13.2.4 Such other details and method statements as may reasonably be required.

14.0 CONTACT BETWEEN DESIGNERS, DEVELOPERS, CONTRACTORS AND IFI.

14.1 IFI is committed in the national interest to working in a positive and cooperative manner with all relevant parties including

representatives of State and public authorities undertaking works in order to ensure that impacts on the fisheries resource are minimised. IFI is obliged to ensure that all structures are designed, installed and maintained so as to ensure the free upstream and downstream movement of aquatic life and the sustainable maintenance of the aquatic and associated riparian zone.

14.2 IFI require that contact be established and maintained between senior representatives of the developer, designer and contractor with responsibility for earthworks, structures and environmental management issues and relevant river basin district personnel in advance of commencement and for the duration of the specified construction project.

14.3 IFI has offices located within each of the River Basin Districts situated wholly or partly in the Republic of Ireland. Contact details and a map showing the locations of IFI's regional offices and areas covered are given in Appendix 1.

14.4 Responsibility for waters in the Republic of Ireland which form parts of the North Western, Neagh Bann and Shannon International River Basin Districts lies with IFI Ballyshannon, IFI Blackrock and IFI Limerick respectively.

APPENDIX 1

CONTACT DETAILS AND LOCATIONS OF IFI REGIONAL OFFICES

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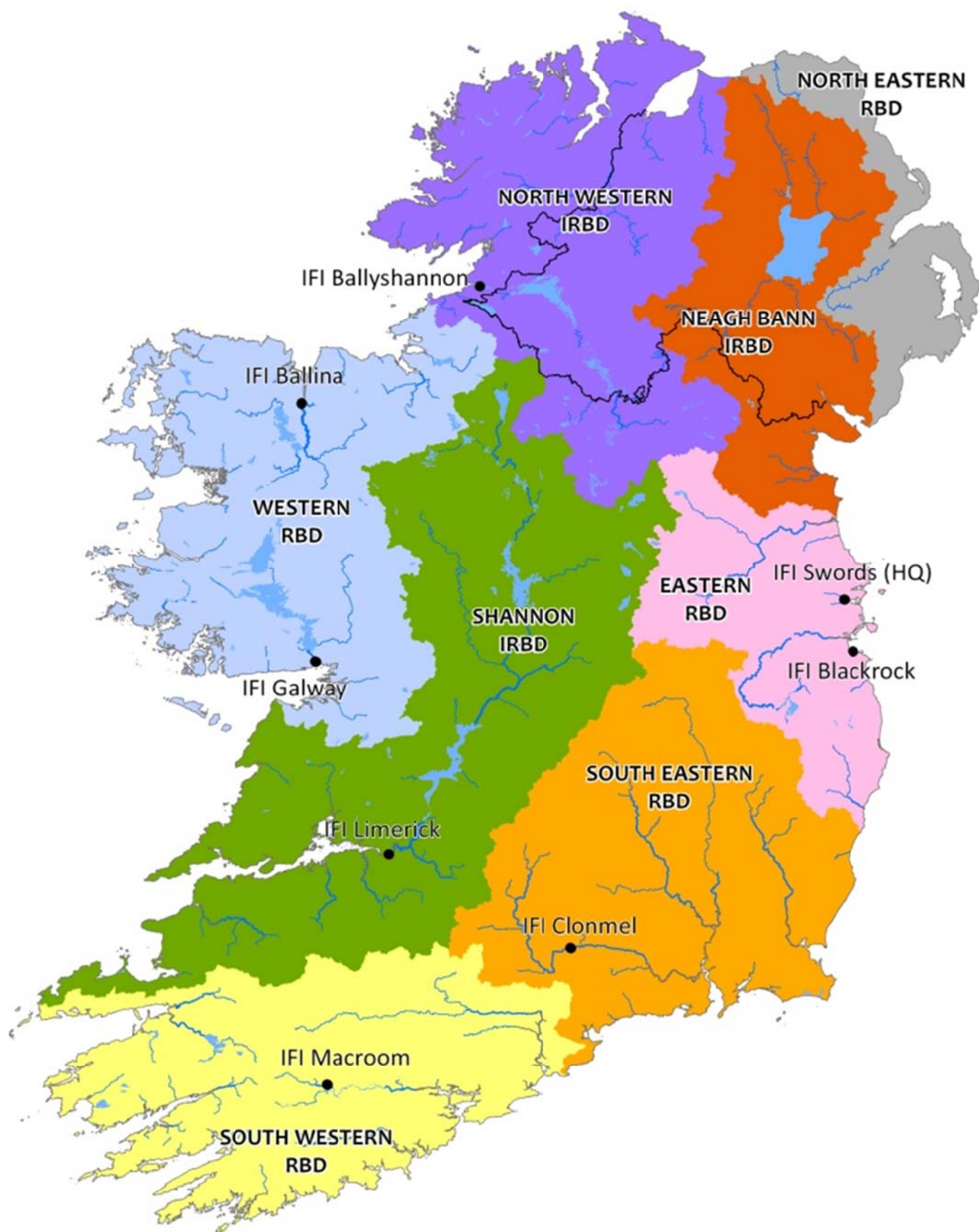
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APPENDIX 2

RELEVANT LEGISLATION

The Arterial Drainage Act 1945.

The Fisheries Consolidation Act 1959 (as amended).

The Fisheries (Amendment) Act 1997.

The Inland Fisheries Act 2010.

Council Directive 78/659/EEC on the Quality of Freshwaters Needing Protection or Improvement in Order to Support Fish Life.

The European Communities (Quality of Salmonid Waters) Regulations 1988 (S.I. 293 of 1988).

European Communities (Quality of Shellfish Waters) Regulations 2006 (S.I. 268 of 2006).

European Communities (Quality of Shellfish Waters) (Amendment) Regulations 2009 (S.I. No. 55 of 2009).

The Wildlife Act 1976.

The Wildlife (Amendment) Act 2000.

The Local Government (Water Pollution) Act 1977.

The Local Government (Water Pollution) Amendment) Act 1990.

The Habitats Directive (92/43/EEC).

The European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. 477 of 2011).

The Water Framework Directive (2000/60/EC).

The European Communities (Water Policy Regulations 2003 (S.I. 722 of 2003).

The European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. 272 of 2009).

The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009 (S.I. 296 of 2009).

GLOSSARY

Alevin Newly hatched salmon, trout or related fish usually with a yolk sac attached which acts as a primary nutrient source, before it emerges from the spawning gravel to begin swimming freely.

Armouring Lining of watercourse banks with rock or other material to protect from scour.

Apron Erosion protection placed below watercourse bed level in an area of high velocity such as downstream of a bridge or culvert.

Cyprinid Belonging to the largest European freshwater fish family. Common examples in Irish waters include roach, rudd, dace, minnow, gudgeon bream and carp.

Ecosystem Any combination of living and non living components that with a supply of matter and energy is self sustaining over a defined period of time

Electrofishing Fishing with electrical devices based on electro-taxis and electro-narcosis (state of immobility resulting from muscular slackening of fish due to electric current).

Gabions Baskets normally made of woven wire and filled with stone/rock or other hard material generally used to form erosion resistant structures.

Habitat The natural abode of a plant or animal, especially the particular location where it normally grows or lives.

Invasive species Species that have been introduced, generally by human intervention, outside their natural range and whose establishment and spread can threaten native ecosystems

Perched Set at an elevated level, or in a higher position, and in the context of culverts – and scour slabs, the tendency to develop a water fall or cascade due to erosion of a watercourse downstream of a structure.

Riparian The terrestrial aquatic interphase or area immediately alongside the bank of a watercourse.

Salmonids The only two indigenous fishes in the genus *Salmo* in Ireland - Atlantic salmon (*Salmo salar* L.) and brown trout (*Salmo trutta* L.).

Terram A geotextile cloth type permeable material normally made from polypropylene or polyester used in construction as a separation layer.

Toe The point at which the bottom of a bank and the bed of the alongside watercourse intersect.

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