

Impact of the Controlled Activities Regulations on Dam Construction, Maintenance and Operation in Scotland

C. W. BERRY, GHD Pty, Australia (formerly of W A Fairhurst and Partners)
K. M. H. BARR, W. A. Fairhurst and Partners, UK

SYNOPSIS. Regulatory pressure is being increasingly focused on engineering activities under the cover of the Water Framework Directive. Consideration of the environment and social impacts of what reservoir engineers and owners do in the future will play an important part in the management of our reservoir stock. From April 2006 all activities in or near the water environment in Scotland will be controlled under the Controlled Activities Regulations with the exception of very minor work with low risk to the environment. This new regime will form an important consideration for reservoir owners, inspecting engineers, consultants and contractors and is likely to have a significant effect on the way engineering works are prescribed and implemented in the future. This paper provides a practitioner's view of the new regulations highlighting the potential effects of these new statutory obligations and the additional burden on reservoir owners. This paper outlines the new regulatory framework and explores the impact on existing and future engineering activities in relation to reservoir works. Two recent case studies illustrate the potential impact drawing on practical experience from the hydro power industry, reservoir owners and engineering works.

INTRODUCTION

The European Union Water Framework Directive (WFD) aims to improve the quality and status of our water environment and recent significant, wide ranging environmental legislation has been enacted with a view to achieving the goals and aspirations of the WFD. Historical human intervention to watercourses and development within our river catchments has placed significant pressure on natural ecosystems. The new Controlled Activity Regulations (CAR) aim to provide a mechanism to ensure the adequate mitigation of the negative impacts created by the construction, operation and decommissioning of impoundments in Scotland. The delivery of such regulation under the ambit of the WFD needs to retain a focus on

IMPROVEMENTS IN RESERVOIRS

sustainability, in terms of achieving, not just environmental improvements, but delivering current and future community needs and demands.

The fundamental principle of the WFD is to improve the ecological status of rivers and water bodies, taking into account the socio-economic context and the demands of different stakeholders. There is general agreement that action is required to target the key factors affecting the status of rivers and water bodies such as water quality (point and diffuse pollution) and morphological impacts. Abstraction and storage of water needs to reconcile other ecological and social demands upstream and downstream in the same catchment.

The WFD was enacted into Scottish law through the Water Environment and Water Services (Scotland) Act 2003. This provides regulatory controls over activities in order to protect and improve Scotland's water environment. In fulfilling their duties Scottish Environment Protection Agency (SEPA) regulate activities such as abstraction, impoundment and engineering activities, as well as discharges, under the Water Environment (Controlled Activities) Regulations 2005 (CAR). A recurring theme of the European Union has been differences in how directives are brought into national law in member states. This is now occurring within the UK, with responsibility for the WFD falling to the Scottish Parliament. There are significant differences between the CAR and the proposals for England & Wales.

BACKGROUND

The introduction of the CAR provides the regulator SEPA with additional and wide ranging powers to influence engineering activities such as impoundments and river works in Scotland. SEPA in the past have influenced such activities through a number of existing legislative frameworks as statutory consultees, such as:

- Town and Country Planning Act 1997.
- Environmental Impact Assessment (Scotland) Regulations 1999.
- Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004.
- Water Orders under Water (Scotland) Act for abstractions (may cover impoundments).
- Flood Prevention Orders (may also cover impoundments).

The introduction of the CAR is in addition to any consent that may be required through the planning process and provides SEPA with much more direct control over future activities.

The new regulations aim to provide a consistent approach to works affecting rivers and water bodies. In the past these works have tended to take a rather

narrow, non-holistic approach to environmental mitigation. It has been shown that engineers have historically taken some cognisance of the environmental impact of reservoir construction, including various forms of mitigation (Turpin, 2000). Such work has often been undertaken unconsciously and unrecognised as part of good design practice. Turpin, 2000 describes factors such as increasing environmental regulation and legislation as having a “design squeeze” on reservoir design construction and operation over the last century. The CAR places additional pressure on reservoir practitioners and operators to draw from their historical role and develop a more holistic approach to reservoir management.

REGULATORY FRAMEWORK

The CAR will affect owners, designers, planners and contractors for both existing and proposed activities. The level of authorisation and control will be based on the risk (to ecological quality) posed by various activities (Fig.1). Significantly, activities such as abstractions (over 10m³ per day), impoundment and engineering in rivers will require some form of registration or licensing. This would apply to both existing and proposed impoundments (over 1m high) regardless of the volume impounded. The Reservoirs Act’s principal focus is on the protection of people, the CAR key driver is protection of the water environment.

Authorisation will be required for all future and existing:

- Discharges
- Abstractions
- Impoundments
- Engineering Activities

‘Engineering Activities’ will cover all work on or near rivers, lochs, wetlands, etc but not transitional waters or coastal waters (covered by an existing licensing regime). Works requiring licensing will include developments in the vicinity of a river or loch and set-back embankments.

It remains unclear what “in the vicinity” means here but it has been suggested that this could encompass any activities in the “functional floodplain”. As such in some cases the CAR may influence works some distance from the controlled water body. Compliance with CAR is required even if the works are covered by other consents e.g. planning consent or road construction consent.

IMPROVEMENTS IN RESERVOIRS

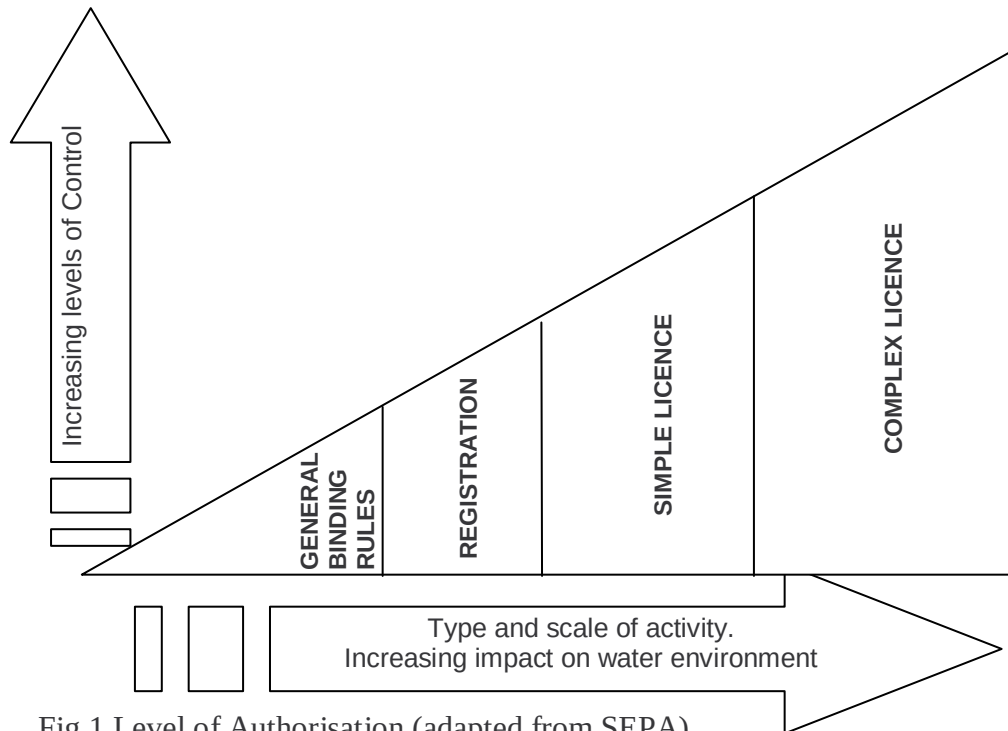


Fig.1 Level of Authorisation (adapted from SEPA)

SEPA will regulate activities in three principal ways depending on the type and size of work and risk to the environment (Fig 1):

- i. Compliance with the **General Binding Rules** (GBR) – This is the simplest level of control covering minor activities with low environmental risk e.g. weirs less than 1m high if constructed before April 2006, abstractions of less than 10m³ per day, small scale bank protection works etc. SEPA do not need to be informed of such activities.
- ii. **Registration** – SEPA will use registration for small-scale activities which individually pose a small environmental risk but which cumulatively can result in environmental harm, e.g. bank protection, sediment management, small river crossings, etc.
- iii. **Licence** –A licence (simple or complex) will be 'person'-specific in that it will require the identification of a 'responsible person' who will be responsible for ensuring that the terms of the licence are complied with. A responsible person can be an individual, a company or a partnership. Licences will be required for both existing and proposed activities (including impoundments, discharges and abstractions) and

where such activities are currently licensed (e.g. discharge consents) application should be made to transfer these over to the new system.

Organisations or people with existing discharges, impoundments or abstractions already consented were required to apply to SEPA during the transitional period between 1st October 2005 and 31st March 2006 to transfer their consents to the new regime.

From April 2006 works must comply with the GBRs or be registered or licensed by SEPA. Within the Regulations SEPA have 4 months from the date of application to make a decision regarding a licence and 30 days for a registration. It is understood that engineering works completed by 30 September 2006 will not require authorisation. However, works likely to continue after September 2006 will require authorisation to proceed. In such cases, where prior environmental impact assessments have not been undertaken through the planning process, significant delays could be incurred to allow SEPA to process the applications and possible additional constraints imposed. Discharges, abstractions and impoundments were enforced from April 2006. SEPA approval could present significant delays in starting or continuing work on site (separate from any planning application periods).

Consultation on proposed new abstraction and impounding licensing regulations to apply in England and Wales and proposed changes to the Water Resources (EIA) Regulations 2003 was undertaken in 2005 (DEFRA, 2005) and the results of the consultation published in March 2006. The level of regulation proposed is thought to be less prescriptive than in Scotland. Specifically, the new CAR will require regulation of all impoundments, maintenance, construction, decommissioning and operations (Table 1).

Table 1. Levels of Authorisation required for Impoundments

GBR	Simple Licence	Complex Licence
Existing passive weirs less than 1m high, not affecting fish passage	All other existing weirs and raised lochs more than 1m high	All new impoundments and operation of all other existing impoundments

Various charges will be applied by SEPA to process applications depending on the type of license and the number of activities involved. Charges will be incurred for each specific activity and many engineering works and reservoirs will have multiple activities, e.g. impoundment, abstractions, river training works and crossing. Annual subsistence charges will also be

IMPROVEMENTS IN RESERVOIRS

applied by SEPA to maintain the various licenses e.g. subsistence charges will be applied to impoundments which do not provide an “Environmental Service”. Annual subsistence charges can be waived where the scheme is shown to provide an “Environmental Service” e.g. the primary purpose of the impoundment is to provide a fishing loch.

IMPACT OF CAR

The CAR will have a significant impact on existing reservoir owners, on any proposed remedial works as part of works in the interest of safety and will encompass impoundments currently not falling within the ambit of the Reservoirs Act 1975, including weirs and dams impounding less than 25,000m³.

SEPA define impoundments as “any dam, weir or other works by which surface water may be impounded but also include any works diverting surface waters in connection with the construction or alteration of any dam or weir” (SEPA 2005). This would include works to raise the level of a natural loch but not a pond created by excavation below existing ground levels. Non impounding reservoirs are not included in this definition.

The impact may:

- Introduce regulation of far more structures than are currently registered under the Reservoirs Act; owners will need to carefully consider their asset portfolio and likely mitigation measures that may be imposed.
- Affect maintenance of structures; previously un-regulated works will need to apply for approval if not covered by GBRs.
- Management of discharges and abstractions may have to be revised to reflect downstream ecology and morphological factors; available flow for hydro power generation may be affected e.g. compensation flows and control of hydro peaking flows.
- Hydro-power assets may require investment to provide mitigation; installation of fish passes, screens, ‘fish friendly’ turbines, etc.

Some of the proposed mitigation measures that may be applicable, particularly to impoundments and hydro schemes may involve non-structural solutions such as a change in operation and discharge regime. However, other measures such as changes to overflow characteristics may be significant and may require alterations that will need supervision of a qualified engineer under the Reservoirs Act 1975. It is clear that the benefit of such work in terms of improvement of good ecological status or potential of the water environment should not be considered in the absence of the statutory requirements of the Reservoir Act in terms of safety. Similarly, the primary function of a facility (power generation, flood control) needs to

be considered and where such benefits outweigh the environmental mitigation, derogation of the CAR should be sought.

The extent and scope of works required to satisfy SEPA in meeting their objectives is unclear. At the time of writing, SEPA were in the process of developing guidance on best practice for engineering works including impoundments. SNIFFER and the Environment Agency have however already produced preliminary guidance on management strategies and mitigation measures for impoundments which presents a step by step approach to identifying appropriate mitigating measures for existing and proposed impoundments (SNIFFER, 2004). The approach considers ecological, socio-economic and financial issues and constraints in the selection of measures. The costs and impact of any measures needs to be balanced against the primary benefit and function of a particular impoundment and the management and decommission of the impoundment. It is this comparison of potential disproportionate cost of mitigation and primary benefits of the structure that has the potential for derogation to be applied for a particular site and equally raises the potential for conflict between the regulator and owners.

The forthcoming guidance will have significant importance in the application and impact of the CAR. It is hoped that that guidance will provide clarity and consistency in the application of the rules both for the regulator and for owners/engineers in assessing what is acceptable. Failure to achieve clear guidance could result in protracted negotiations with SEPA and costly delays in implementation of engineering works. The environmental measures that may be imposed through the CAR need to recognize the primary function of many reservoirs and engineer's recommendations under the Reservoirs Act 1975.

Any activity to mitigate the environmental impact of an impoundment must reconcile the protection of the local aquatic ecology with the socio-economic benefits of impoundments and must fit within the overall River Basin Management Plan (RBMP) process (SNIFFER, 2004). It is the extent of such impacts and the level of mitigation as it relates to the overall RBMP that is currently being developed by the regulator.

EXAMPLES

The following examples of recently completed works are discussed to demonstrate the potential effect the CAR would have had on the outcome of the as built schemes. Two example have been presented, the first a new hydro power scheme, the second a new flood storage reservoir.

IMPROVEMENTS IN RESERVOIRS

Garrogie Hydro Scheme

Garrogie hydro scheme consists of a 2.7MW run-of-river project constructed near Fort Augustus, Scotland, upstream of the Fechlin Intake on the River Fechlin. The project involved construction of a 9m high concrete gravity dam (Fig.2) serving as the intake together with a 2.6km penstock leading to the turbine house. The penstock followed the course of the river with two significant bridge crossings spanning the river.



Fig. 2 Garrogie Hydro Scheme Intake Dam

Consultation with SEPA and SNH as part of the planning process established various environmental condition and mitigation measures, including compensation discharge rates. Provision for fish passage was not considered necessary given the existing downstream barriers and this was agreed as part of the consultation process.

An environmental impact assessment was undertaken as part of the scheme however it is likely that this would require to be expanded as part of the CAR process with more focus on mitigation activities such as river enhancement and wildlife habitat provision. In addition, the license may in the future impose greater conditions on compensation discharges to the river during low flow with the potential to reduce the available flows to the turbines.

BERRY & BARR

The following list indicates the various activities that would be applicable to license the scheme.

- Impoundment.
- River training works (<250m of bank).
- Construction of temporary river diversion works.
- Tailrace.
- Abstraction.
- Discharge (from tailrace).
- River crossing, 2 (road bridge and pipe bridge).

Where there are multiple activities as part of a single scheme charges can be reduced. Annual subsistence charges are also applicable to the scheme, as the primary function of the project does not offer any “Environmental Service”. Whilst charges are small, around £8,000 compared to the capital outlay and annual operating costs of a scheme of this size, the costs to smaller private owners and operators could be significant.

Corselet Road Flood Storage Reservoir

Corselet Road Flood Storage Area is located in Darnley, in the south of Glasgow on the Brock Burn, a tributary of the White Cart Water. The storage area provides compensatory storage for floodplain storage lost by during the redevelopment of Pollok town centre. As part of the construction of the new Silverburn shopping centre at Pollok an area formerly used as a recreation ground was infilled. The recreation ground was retained as floodplain when the Brock Burn Flood Prevention Scheme was constructed. A low lying area upstream of Corselet Road, Darnley was identified as a suitable site for a compensatory flood storage area. The storage area was constructed in 2004-2005 and is registered as a large raised reservoir under the Reservoirs Act 1975.

The flood storage area was created by construction of a homogeneous clay embankment 4m high and about 240m long. It is designed to retain 96,000m³. The Brock Burn passes through the embankment in a corrugated metal culvert. The storage area is normally dry with flood flows beyond the 1 in 5 year return period flow being retained by a reinforced concrete orifice control structure at the upstream end of the culvert (Fig 3).

The embankment is designed to overtop in events beyond a 1 in 500 year return period. A length of 180m of the embankment acts as a spillway and is designed to pass the Probable Maximum Flood. The downstream face is therefore reinforced with erosion control mat with hollow concrete blocks at the toe. A number of ecological enhancement features have been included including wildlife ledges in the culvert and the creation of a wetland area upstream of the embankment.

IMPROVEMENTS IN RESERVOIRS

The areas of high flow velocities precluded the use of 'soft' engineering measures downstream. The balance between achieving environmental enhancement and ensure the safety of the embankment to cope with extreme events was discussed with SEPA.



Fig 3. Corselet Road Flood Storage Reservoir

The following activities would require a Complex Licence under the CAR:

- Impoundment.
- Culvert.
- River training works and bank stabilisation.
- Construction diversion works.
- Dredging to remove material from channel bed.

It is understood that an annual subsistence charge will be applicable although the structure provides an environmental service i.e. wildlife and wetland habitat and public amenity, because its primary function is flood storage.

FUTURE ROLE OF RESERVOIR ENGINEERS

A pragmatic approach is required from both the regulator and practitioners in delivering the goals of the CAR. Long term sustainability of solutions and engineering works need to be considered not just from an ecological view but also considering durability, safety of maintenance and operational costs.

There is a pressing need to strike a balance between the principles of flood management, maintenance and safety of reservoirs against social equity, economic efficiency and the need to conserve natural resources. It is believed that the CAR provides the opportunity to better manage this process.

Appreciation and correct application of ecological and hydraulic concepts can lead to decreased costs and environmental risks as well as added landscape, economic and community value. Whilst a proactive approach is desirable the current subjective nature of selection of river enhancement measures and application may lead to resentment amongst some stakeholder groups. Early consultation and collaboration between stakeholders is essential in agreeing the level of mitigation measures required.

It is suggested that engineers can play an important role in raising awareness of some of the issues involved with the CAR and in the development of clear and concise guidance on the best practice. Guidance should not be prescriptive but allow for some flexibility and creativity to suit the site and environmental constraints and practicalities. Systems and solutions can be placed under exhaustive scrutiny and analysis but the importance of careful detailing cannot be understated. An adaptive learning approach is suggested applying the 'best' system within the current level of knowledge and data available and allow for further improvements after its implementation and collection of actual performance data.

A holistic approach has been widely adopted by reservoir practitioners in the past and will continue to be practiced. Indeed many schemes currently promoted apply significant mitigating measures and would be unchanged by the CAR. It is therefore important that such experience and best practice is brought to the table during consultations and development of schemes

CONCLUSIONS

The introduction of the CAR will play an important role in ensuring future and existing activities and impoundments take due consideration of river and loch ecology and morphology. As a result, reservoir engineers and owners will need to take a more holistic approach to the operation and maintenance of reservoirs and impoundments. The successful implementation of the CAR will undoubtedly be a challenge for both SEPA and practitioners and places an additional burden on smaller private owners in addition to annual costs of monitoring of reservoirs under the Reservoirs Act 1975.

There is no doubt that previous engineering activities and neglect of our watercourses has removed ecological habitats and value and that to redress this problem more proactive regulation and implementation of mitigating

IMPROVEMENTS IN RESERVOIRS

measures is required. However, short term environmental impacts should be off set against future gains through careful design and innovation in engineering works. Use of 'soft' engineering techniques provides a useful additional tool but such measures need to be sustainable in relation to long-term stability and management. Greater understanding of the geomorphological processes will be essential and engineers will have an important role and opportunity in developing innovative functional solutions.

The aspiration of improving our environment and the sustainability of projects is shared by all. The key is to ensure that environmental improvement remains the key focus rather than the management of the regulatory process itself.

ACKNOWLEDGEMENTS

The authors wish to thank colleagues at W. A. Fairhurst and Partners for their help and advice in the preparation of this paper. The views expressed are those of the authors and not necessarily those of W. A. Fairhurst & Partners, SEPA or GHD Pty Ltd

REFERENCES

- Defra, 2005, Consultation on new abstraction and impounding licensing regulations to apply in England and Wales and proposed changes to the Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003, Defra, September 2005.
- ICE, 1996, Floods and Reservoir Safety, 3rd Edition. Thomas Telford, London.
- SEPA, 2005, Consultation on the Water Environment Charging Scheme 2006 (Water Environment (Controlled Activities) Fees and Charges (Scotland) Scheme 2006), SEPA.
- SEPA, 2005, Levels of Authorisation under the Water Environment (Controlled Activities) (Scotland) regulations 2005, SEPA.
- SNIFFER, Environment Agency, 2004, Management Strategies and Mitigation Measures Required to Deliver the Water Framework Directive for Impoundments, WFD29/Vol.1 - Preliminary Guidance Document, FWR.
- Turpin, T.J., 2000 Environmental Impacts of Dams: the changing approach to mitigation, Dams 2000, Thomas Telford, London.